Vaughn® MOTOBLOC® MOTOBLOX®

with AIR and WATER

for perfect wire condition from start to finish!

"Quick on the Draw!"®

Vaughn **DOUBLE-COOLED** blocks insure desirable temperatures for high carbon wire all the way through the draw—thanks to advanced engineering that provides *both* air and water cooling. Each block is equipped with an annular air blast for external cooling of the wire, while water jets impinging on the inner finned block walls remove heat continuously and effectively. • *Let us discuss the benefits to your wire on your operation!*

The Vaughn Machinery Co., Cuyahoga Falls, Ohio, U.S.A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

Payoffpak®...

Continental's new way to send a wire

By automatically packaging wire as it is drawn, Continental's Payoffpak has revolutionized the handling of wire! These fibre drums put an end to small manually handled coils that are costly to produce and costly to use. What's more, the wire is untouched by dirty or sweaty hands and remains protected in the sturdy drums until ready to use. Lightweight Payoffpaks can hold 600 lbs. of wire each; high stacking strength means you can save on storage space too.

So check into Payoffpak—it will mean bigger profits for you. Call Continental soon for the interesting facts.

CONTINENTAL CAN COMPANY

FIBRE DRUM AND CORRUGATED BOX DIVISION

NEW YORK, N. Y.

Van Wert : Philadelphia : Pittsburgh : Tonawanda : Cleveland : Chicago
Atlanta : St. Louis : San Francisco : Los Angeles : Eau Claire : Boston

THE MANUFACTURERS OF

"America's Finest Wire Drawing Lubricants"

after substantial RESEARCH and MILL-TESTING, are prepared to offer LUBRICANTS for the drawing of Steel Rod and Wire that impart a protective coating, compatible with the end use of the product, for nominal storage during Warehousing and Shipping.

You are invited to consult with our Technical Sales Staff to ascertain the best lubricant to use to solve your problem.

Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.

Sincerely,

Standard Industrial

COMPOUNDS CO., INC.

FRANKFORT, ILLINOIS
Telephones: 2131-2141

John A. Moritz
c/o Standard Industrial
Frankfort, Illinois

Eric Meutlein
c/o Standard Industrial
Frankfort, Illinois

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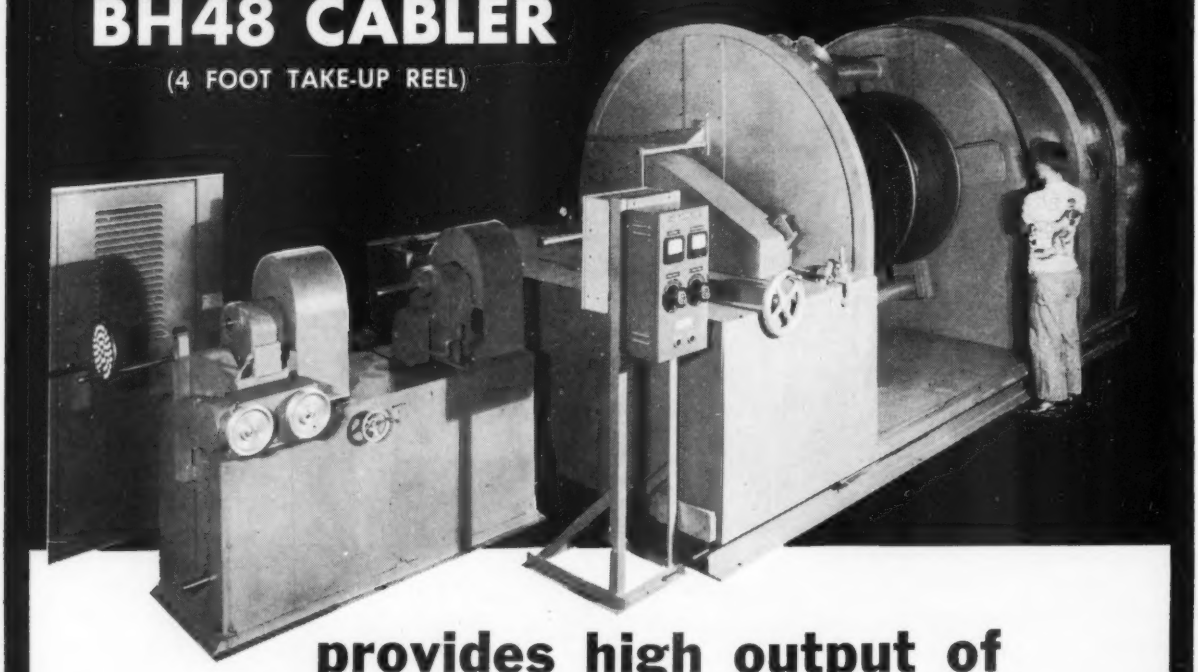
66 Dolphin Drive
City of Treasure Island 6, Fla.

new! COOK

BH48 CABLER

(4 FOOT TAKE-UP REEL)



provides high output of quality cable at lowest cost

The Cook BH48 is truly a speed demon! At 6" lay it will produce up to 12,000 feet per hour of the highest quality cable ever. That's production! And the Cook BH48 is versatile too. Two wires . . . a hundred wires . . . or more . . . the Cook BH48 will handle any number to make cable up to 1⅛" maximum diameter. That's versatility!

Whether you twist insulated wire, uninsulated wire, or both, you can count on the Cook BH48 for economy too. It's easier to string up (because it has no capstan), easy to operate (features simplified pushbutton controls), and is available with cotton, cloth, and paper wrapping attachments.

Want more information? Write today for the complete details.

SPECIFICATIONS

PRODUCTION:	12,000 ft/hr at 6" lay
FLYER SPEED:	400 rpm maximum
REEL SIZE:	48"F x 24"T x 22" barrel x 8" bore
FLOOR SPACE:	7'6" x 16'0"
LAY RANGE:	1½" to 18"
TWIST:	Right or left hand
FINISHED WIRE SIZE:	1⅛"
WRAPPING HEAD:	Optional
NEUTRALIZER:	Optional
Also Available in 36" and Other Sizes	

COOK

MANUFACTURING CO.

50 EAST 25th STREET, PATERSON, N. J. • ARMORY 4-6380

•

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E. V. LARSON CO., LTD., TORONTO, CANADA

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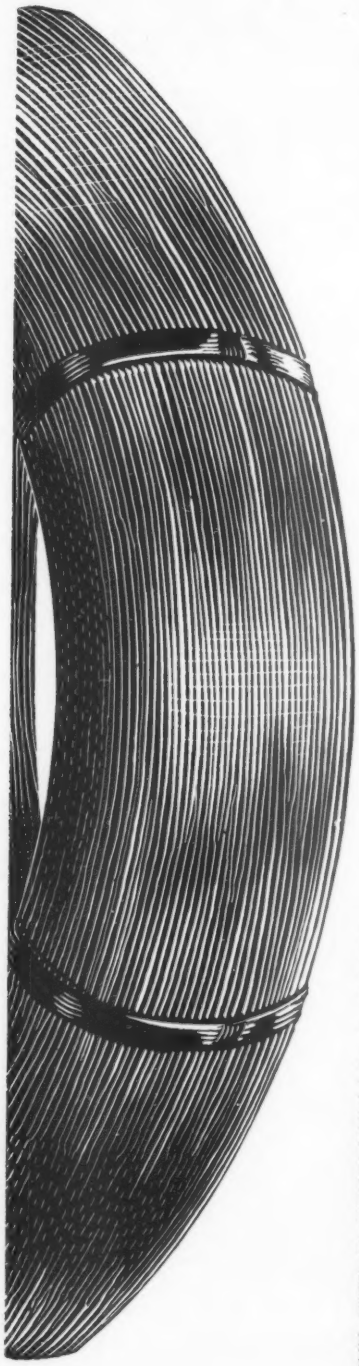
CAPAMADJIAN LE MONNIER CIE LTD., PARIS, FRANCE



209 DIFFERENT KINDS OF WIRE

. . . *and Youngstown Makes Them All*

No matter what type wire you require, Youngstown should be your specification for high quality, uniformity and dependability. That's because they are all drawn from specially refined open-hearth carbon steels to meet your most exacting specifications.

Every grade of Youngstown Wire is rigidly quality-controlled in all steps of its production from ore mining to finish drawing and coating. This guarantees you a uniform product—both chemically and physically—that's free from injurious seams and piping, laps, die marks, as well as internal tearing and cupping.

Why not study this listing—it may suggest new products you could make from Youngstown Wire to boost both your sales volume and profits.

For additional information or metallurgical assistance, write or phone today to your nearest Youngstown District Sales Office.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

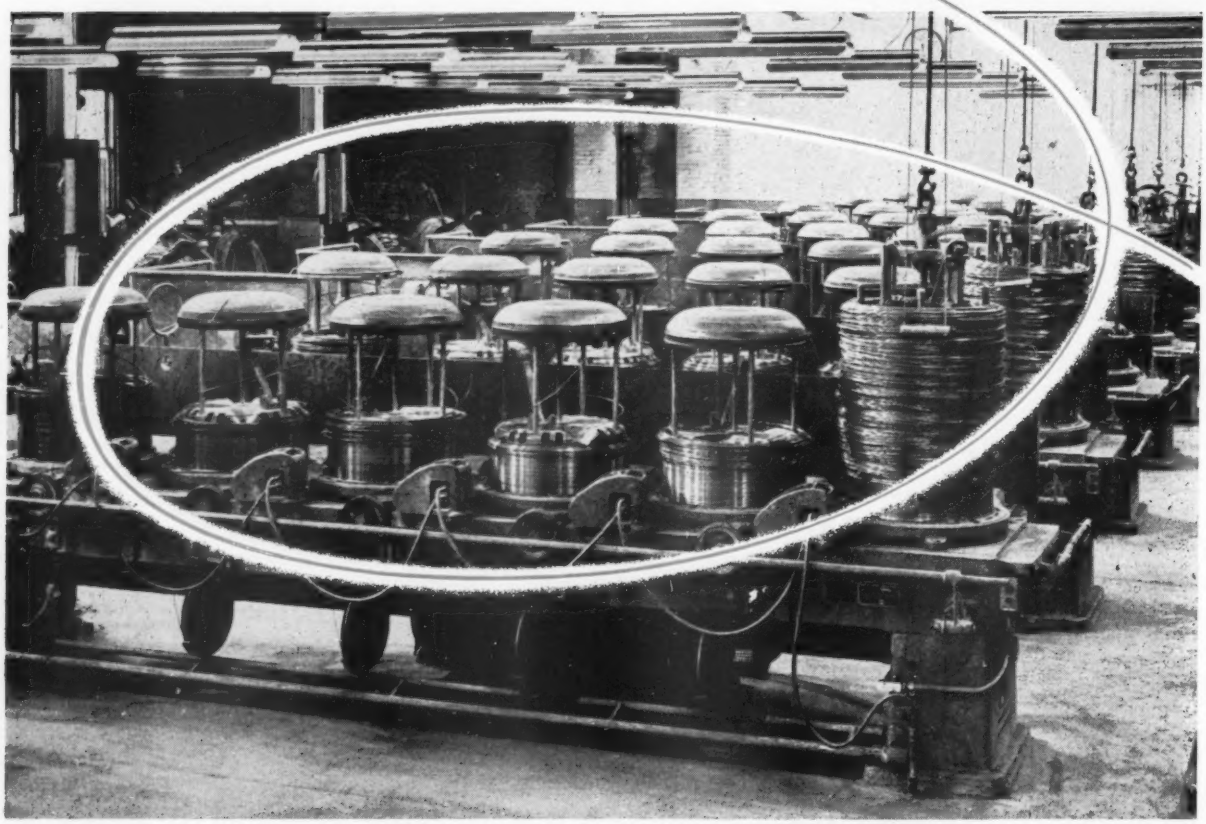
Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio

District Sales Offices in Principal Cities

Aircraft Wire
Alloy Wire
Annealed Wires
Armor Wire: Armoring Wire
Artificial Flower Wire
Automotive Wire
Awl Wire
Axle Wire
Bail Wire
Bale Tie Wire
Baling Wire
Ball Pin Wire
Basic Wire
Basket Handle Wire
Bed Rods
Bessemer Spring Wire
Bicycle Chain Stud Stock
Bicycle Spoke Wire
Binding Wire
Bolt and Rivet Wire
Bond Wire
Bonnet Wire
Bookbinder Wire
Border Wire
Bottle Handle Wire
Bottling Wire
Box Binding Wire
Box Hinge Wire
Brace Wire
Brick Cutting Wire
Bright Wire
Broom Wire
Brush Wire
Buckle Wire
Bundling Wire
Button Hook Wire
Cable Armor Wire
Can Key Wire
Cap Screw Wire
Car Heater Wire
Car Seat Wire
Card Wire
Cast Steel Wire
Ceiling Hook Wire
Chain Welding Wire
Chain Wire
Chair Rods
Chair Wire
Channel Bead Wire
Channel Pin Wire
Check Rower Wire
Clasp Wire
Clip Wire
Clothes Line Wire
Clothes Pin Wire
Coat Hanger Wire
Coat and Hat Hook Wire
Coiled Spring Wire
Cold Heading Wire
Concrete Reinforcement Wire
Copper Bearing Wire
Coppered Wire
Core Wire (A.C.S.R.)
Cork Screw Wire
Cotter Pin Wire
Crimping Wire
Croquet Arch Wire
Curry Comb Wire
Curtain Rods
Damper Rods
Double Clinch Wire
Dowel Wire
Duck Bill Nail Wire
Eave Trough Hanger Wire
Edge Wire
Elevator Hoisting Cable Wire
Fence Wire
Ferrule Wire
Fine size Wire
Firing Pin Wire
Fish and Leader Wire
Flesh Fork Wire
Flexible Shaft Wire
Florist Wire
Foundry Core Wire
Frame Wire
Fruit Jar Wire
Fuse Wire
Galvanized Wire
Galvanized Armor Cable Wire
Galvanized Brace Wire
Garment Hanger Wire
Gate Hook Wire
Grape Tie Wire
Grass Catcher Wire
Guard Wire
Gun Wrapping Wire
Hairpin Wire
Handle Wire
Harness Snap Wire
Hat and Coat Hook Wire
Hat Rods
Head Lining Wire
High Carbon Wire
Hog Ring Wire
Hook and Eye Wire
Hoop Wire
Hose Binding Wire
Husking Pin Wire
Key Wire
Key Ring Wire
Key Stock
Keystone Wire
Lacing Wire
Lantern Wire
Lathing Wire
Link Wire
Lintel Wire
Lock Washer
Loop Wire
Machinery Wire
Machine Screw Stock
Manufacturers' Wire
Market Wire
Mat Border Rods
Mat Wire
Mattress Wire
Metal Stitching Wire
Muzzle Wire
Nail Head Wire
Nail Wire
Neck Wire
Neck Yoke Ring Wire
Netting Wire
Nickel Steel Wire
Non-corrosive Wire
Nut Cracker Wire
No-Sag Spring Wire
Oval Wire
Oven Rack Wire
Pail Bail Wire
Pail Rim Wire
Piano Rods
Pin Wire
Pinion Wire
Pivot Wire
Pipe Winding Wire
Plow Steel Wire
Plunger Wire
Pneumatic Tire Bead Wire
Pot Chain Wire
Poultry Netting Wire
Pump Chain Wire
Rake Tooth Wire
Refrigerator Shelf Wire
Reinforcement Wire
Riveting Wire
Rivet Rods
Rivet Wire
Rock Fastener Wire
Roll Threading Wire
Rope Wire
Saddle Spring Wire
Sash Cord Wire
Scrapless Nut Wire
Scratch Brush Wire
Screen Wire
Screw Wire
Screw Driver Wire
Screw Rod Wire
Shade Roller Wire
Shelf Wire
Skid Chain Wire
Smooth Wire
Snare Wire
Soft Processed Wire
Spark Plug Wire
Spiral Hooping
Spoke Wire
Spring Wire
Stapling Wire
Stitching Wire
Stone Wire
Stove Bolt Wire
Stove Pipe Wire
Stove Rods
Straightened & Cut Wire
Strapping Wire
Stud Stock
Surveyors' Chain Wire
Tack Wire
Tag Wire
Tie Wire
Tire Bead Wire
Towel Rods
Toy Wire
Trap Spring Wire
Transom Rods
Trellis Wire
Tuning Pin Wire
Tying Wire
Umbrella Wire
Wash Boiler Wire
Weaving Wire
Welding Wire
Whip Guard Wire
Wood Screw Wire
Wrapping Wire
Zig Zag Spring Wire

MORGAN-CONNOR
AIR COOLING
gives You Fast Drawing—
Superior Products



A battery of Morgan-Connor Machines in operation. Note the minimum space required for each machine.

Morgan-Connor Wire Machines use an exclusive air-cooling method to keep the wire <u>really</u> cool.

Results — a superior product!

WM-103

MORGAN CONSTRUCTION COMPANY • WORCESTER, MASS.

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 32 November, 1957 No. 11

Designated as Official Publication By The Wire Association

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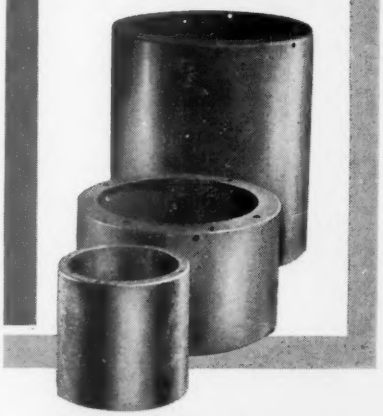
REPUBLIC MAKES OVER 100 SIZES OF

Flanged Steel Traverses



Republic offers one of industry's largest selections of Flanged Steel Traverses. Sizes range from 12" to 56" in diameter and from 6" to 48" in length. Finishes include plain, painted and hot dipped galvanized. Width of flange and number of bolt and drain holes can be furnished to your specifications.

Republic "Reinforced Type" Steel Traverses have extra strength where it is needed most—at bolt holes and base of flange. Reinforcing permits use of lighter gage steel. Saves up to 20% in weight while increasing over-all strength. Send coupon for more information.

REPUBLIC STEEL CORPORATION
DEPT. C-4076
3222 EAST 45th STREET • CLEVELAND 27, OHIO

Send more information on Flanged Steel Traverses.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

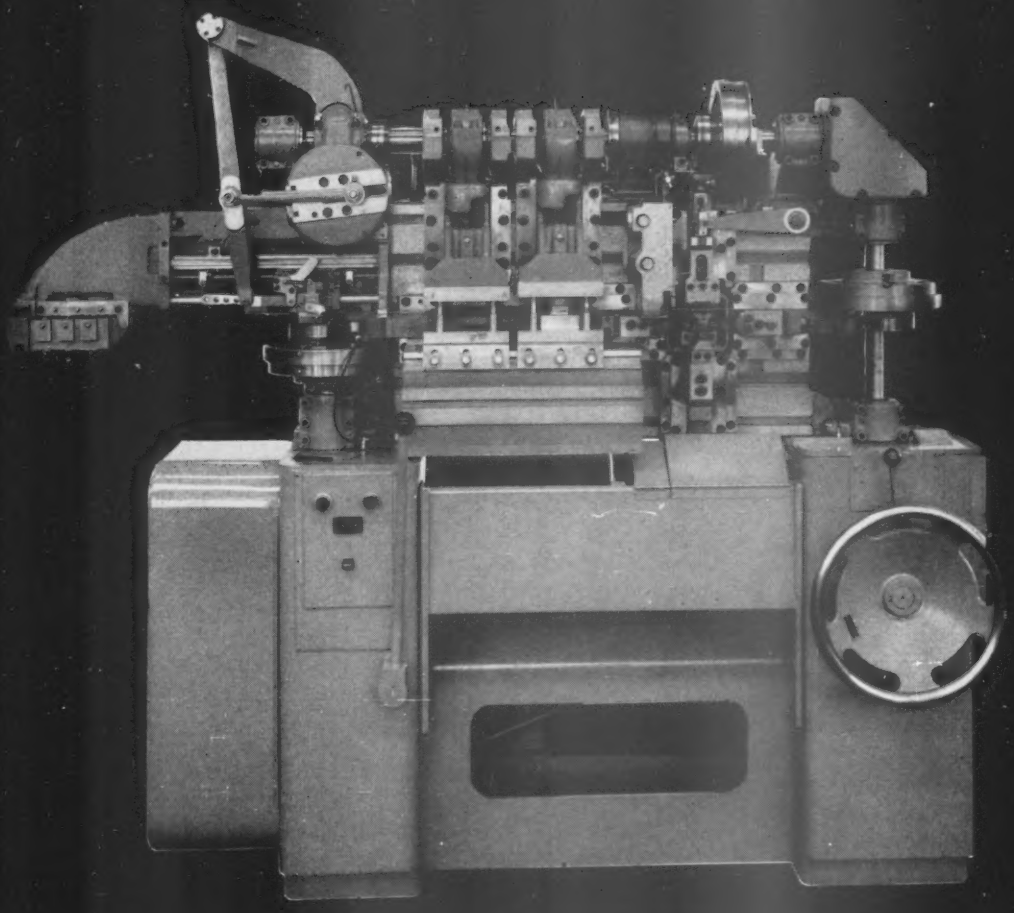
A Great New Vertical *4-Slide*

The Torrington Verti-Slide!

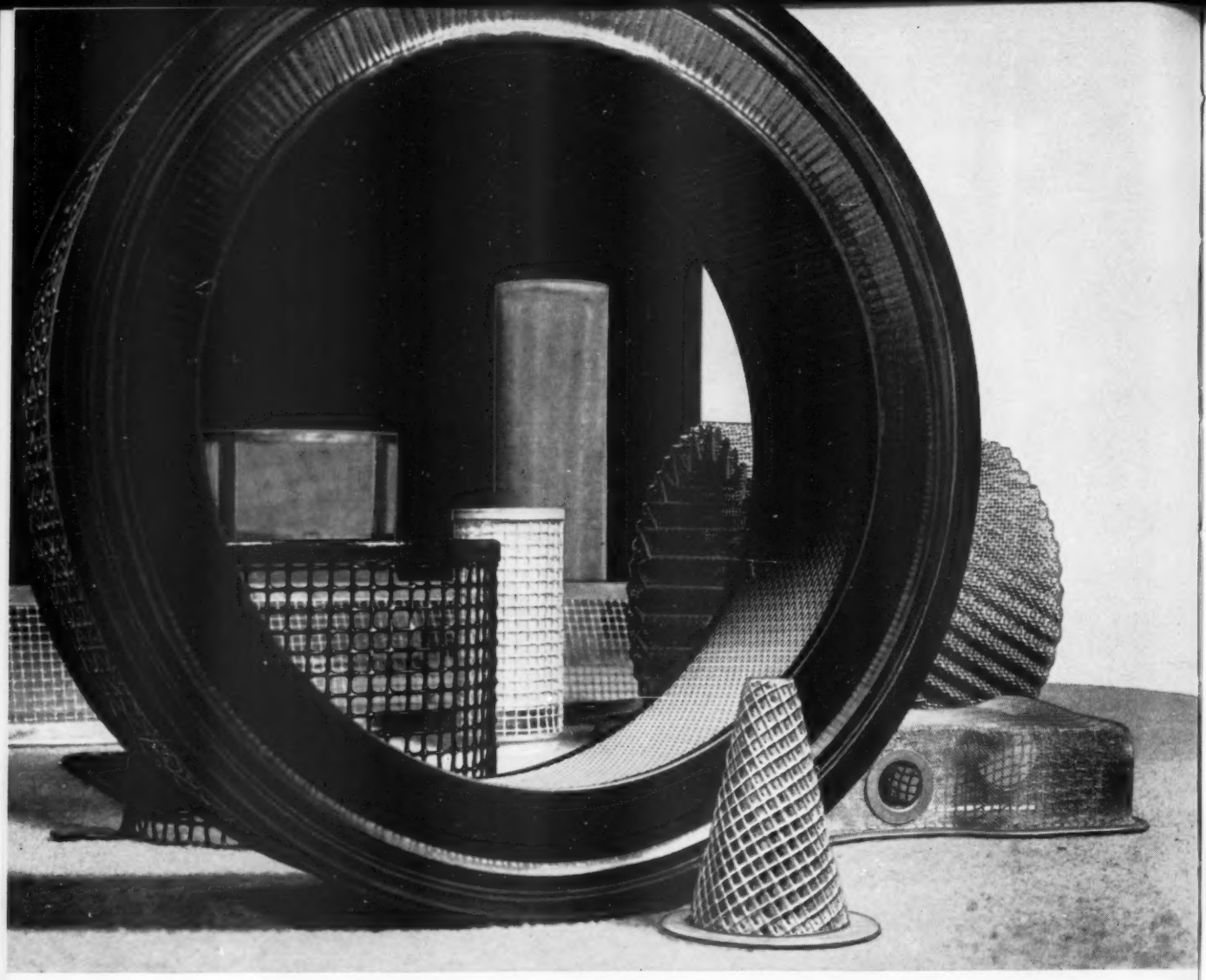
This important innovation in the basic field of 4-slide production equipment offers so many advanced design features, performance advantages and cost-cutting facilities that it is making national news as a development of major interest to U. S. industry.

NATIONAL NEWS

For the Torrington *Verti-Slide* was designed to meet a fundamental need for greater versatility, lower tooling cost, faster set-up time and reduced floor space. We urge you to investigate the *Verti-Slide* in detail at the Metal Show, Booth 1567, or through direct communication with our Machine Division.



THE TORRINGTON MANUFACTURING COMPANY



How to **USE** wire cloth at lower cost

Today many companies are able to make wire cloth components, like these shown here, at lower cost than ever. The answer lies in new services, new developments worked out by the *Reynolds Wire Division* of National-Standard . . . ideas aimed at the more effective, less wasteful *use* of industrial wire cloth. For example . . .

5 SUGGESTIONS:

1. Check on wire cloth rolls 2 to 8 times normal length . . . for 2 to 8 times as much production in a single run. Fewer shutdowns. Less handling.

2. Consider pre-slit widths, plain or with woven-in reinforcement, as narrow as 1 inch or less, to meet your requirements exactly with minimum handling and waste.

3. Evaluate Reynolds' new palletized packaging. Less chance of damage. Faster, easier handling on arrival, in and out of storage and right to production operations.

4. Look into the many different weaves, meshes, metals, finishes and coatings . . . some unique with Reynolds . . . to make sure of the optimum specification for your requirement.

5. By all means take advantage of Reynolds' engineering and analytical service . . . nation-wide and unmatched in the industry. Time and time again it contributes to a better finished product at lower cost.

NATIONAL NS NATIONAL-STANDARD **STANDARD**

DIVISIONS: NATIONAL-STANDARD, Niles, Mich.; *tire wire, stainless, music spring and plated wires* • WORCESTER WIRE WORKS, Worcester, Mass.; *music spring, stainless and plated wires, high and low carbon specialties*
WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* • ATHENIA STEEL, Clifton, N. J.; *flat, high carbon spring steels* • REYNOLDS WIRE, Dixon, Ill.; *industrial wire cloth*

2 BIG, NEW FEATURES

"AUTO-SPEED CAMMING"

With this new built-in feature, the obstacle of limited forming time is overcome.

The cams rotate seven times faster which allows more forming work during recoil, and reduces secondary operation costs.

It also offers quick power testing of tool set-ups before running.

The machine can be converted easily to standard camshaft operation.

"ELECTRO-GRIP SLIDE-FEED"

with reciprocating cutter tube

Highly accurate wire feed is made possible by adjustment against positive stops.

Spring tension eliminates slack and play in the slide movement.

The reciprocating cutter tube accurately guides wire to the arbor driving pin and holds wire during winding.

The machine has a separate switch for gripping and releasing wire for convenience in threading.

#0 Torsion Spring Machine, 607 Series

Here is the most advanced model of a standard production machine from the pace-setting manufacturer of spring coiling machinery. Easier to operate, it gives you greater accuracy and increased work performance and offers you more advantages than any other torsion spring machine made. This and other models in S&H's complete line of torsion spring machines have these two all-important built-in features.

S&H Torsion Spring Machines are also manufactured with "across the front" camshafts.

Write for latest information...

SLEEPER & HARTLEY INC.

BOX 1249, WORCESTER, MASS., U. S. A.

EST. 1911

ORIGINAL MANUFACTURERS OF UNIVERSAL SPRING COILERS

WIRE MANUFACTURERS...

Coulter & McKenzie
Draw-Pak
Model 227 shown

CUT PRODUCTION COSTS, INCREASE SALES WITH

Jal-Pak

THE NEW *SERVICE-PROVED* J&L WIRE PAIL

Count these J&L Jal-Pak advantages that add up to customer satisfaction and increased sales for you:

- Advanced design featuring a rolled smooth side seam available only in J&L Jal-Pak
- Protection in shipment and storage that only steel can offer
- Smooth interior surfaces that prevent damage to wire
- Rigid cylindrical cores of steel or fiber for trouble-free packaging and dispensing
- Lower investment—no deposit—no return
- Colorful decorations that "sell" wherever your product is seen

Jal-Pak Wire Pails are designed with your production problems in mind. Jal-Pak is a natural receptacle for use in line. It is easily adapted to any reel-type winding machine—single or multiple head—and saves you money through:

- Reduced downtime—no rethreading, replacing or rejoining is necessary
- Optimum winding speeds for the wire producer due to longer continuous lengths in Jal-Pak
- Increased productivity of men on the line
- Reduced in-plant handling operations

Jal-Pak Wire Pails are suitable containers for most types of wire including brass, copper, steel, aluminum, stainless steel, alloys and resistance, welding and soldering.

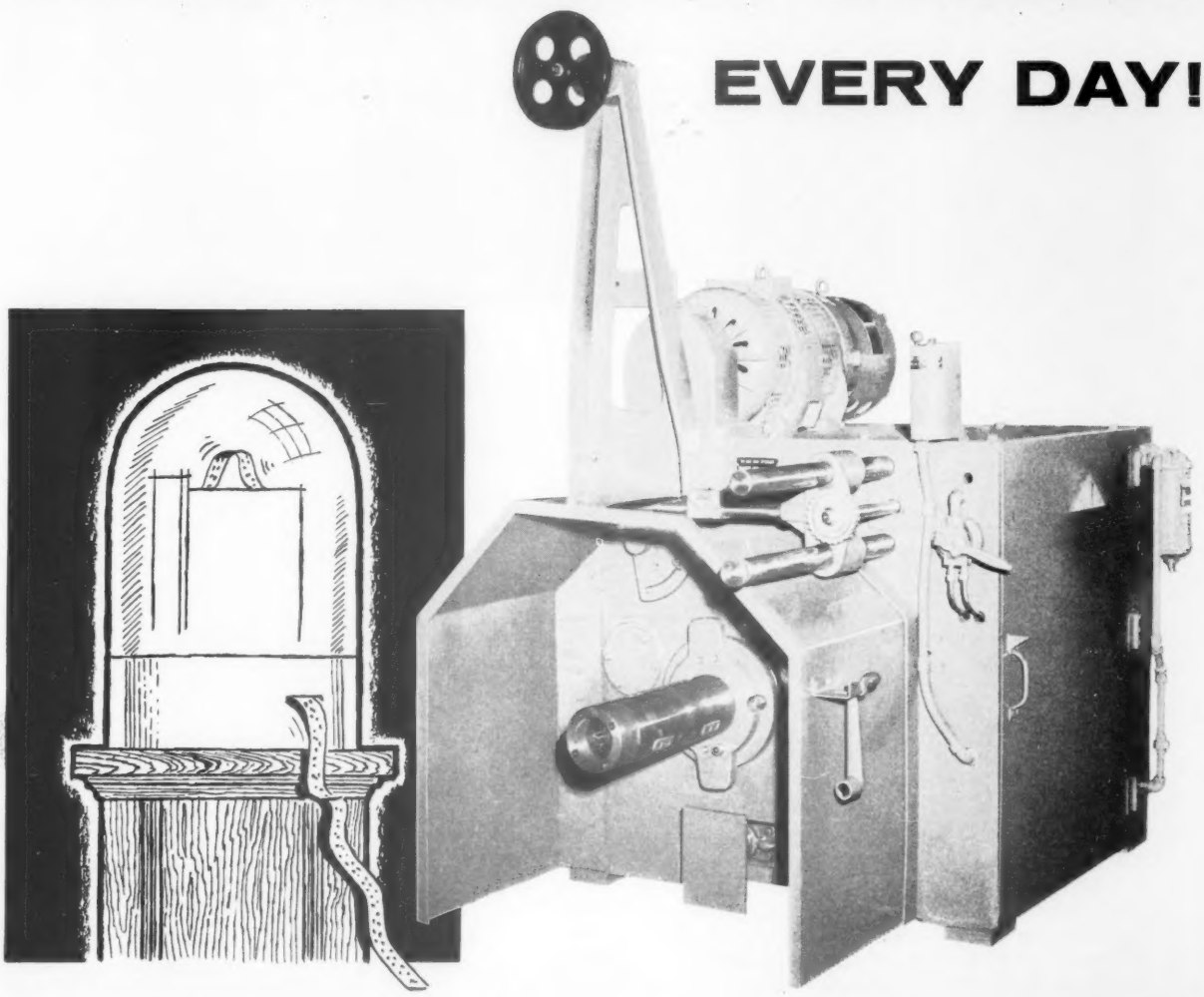
You can start packaging your wire in Jal-Pak *now*. Quotations will be made immediately. Delivery is guaranteed in two weeks.

For complete information on how Jal-Pak can increase production and sell more wire for you, contact your nearest J&L representative or write direct to our Container Division.

J&L STEEL

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH
Container Division
405 Lexington Avenue, New York 17, N. Y.

PAYING PRODUCTION DIVIDENDS EVERY DAY!

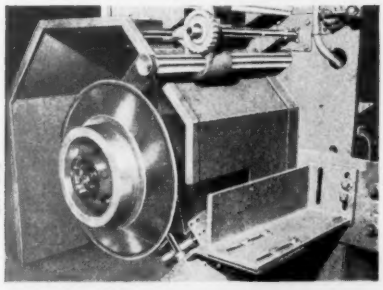


Wire and cable production plants the world over have proved for decades, and are proving every day — SYNCRO equipment pays valuable production dividends. Lowering production costs with SYNCRO's superior machinery is your industry's most potent weapon in today's keen competitive markets.

Here, for example, are some of the profit-producing features of the SYNCRO Spooler Model DFH shown above:

- **Extra high Speed Operation**
- **Fully adjustable Hydraulic Traverse**
- **Air or Electric Brake**
- **Air Operated Reel Ejector**
- **Air Operated Expanding Arbor**
- **"Liminator"***

The Syncro seal is your guarantee that superior production is profitable production.



"Liminator"*

eliminates hard starting ends of wire when spooler is used in combined drawing and annealing operations — write Syncro for details.

*Trademark Applied For

SYNCRO MACHINE COMPANY

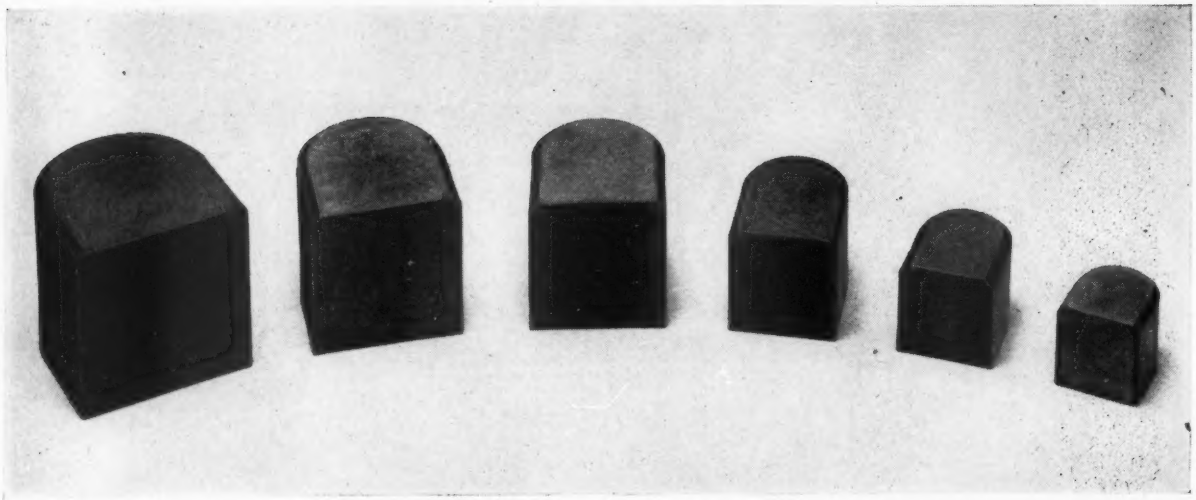
Perth Amboy, New Jersey, U.S.A.

affiliated company: WINGET SYNCRO Ltd. Rochester Kent, England

Better Machinery for the Wire Industry

SYNCRO®

WIRE DRAWING MACHINES • DIE STRINGERS • CONTINUOUS ELECTRIC ANNEALERS • PAYOFFS • CAPSTANS • WIRE INSULATORS • HEAVY DUTY TAKEUPS • TAPERS • SPECIAL MACHINERY



Yes, we have Firthaloy Carbide NAIL DIE INSERTS

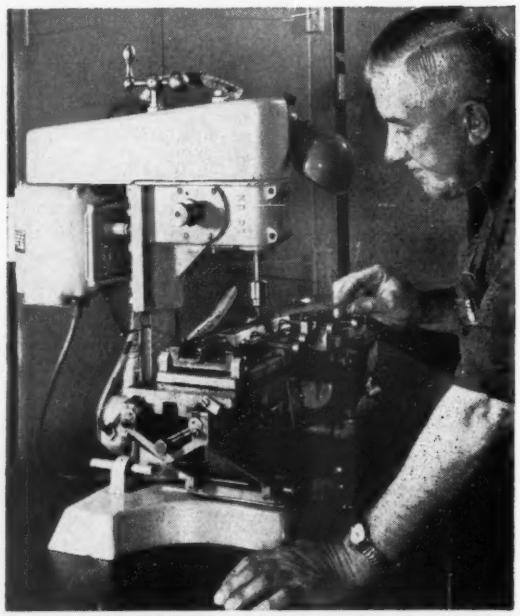
Firthaloy Nail and Tack Die inserts are available from warehouse and distributor stocks in 8 sizes covering the complete range of nail tooling needs. Standards NT-1 to NT-8, specifications for which are shown below, are furnished unground. Ground inserts or sizes or grades other than standard are furnished upon request, of course.

Firth Sterling pioneered the development of sintered carbides for nail and tack tooling. Firth Sterling also designed and developed the only nail die barbing machine available to industry. The combination of high production Firthaloy nibs and Firth Sterling tool room finishing equipment assures lowest die cost with maximum production.

SPECIFICATIONS

INSERT NUMBER	DIMENSIONS				GRAM WEIGHT
	T	W	L	R	
NT-1	3/8	3/8	7/16	3/16	14.77
NT-2	7/16	7/16	9/16	7/32	25.84
NT-3	1/2	1/2	11/16	1/4	41.25
NT-4	5/8	5/8	3/4	5/16	70.30
NT-5	11/16	11/16	13/16	11/32	92.18
NT-6	3/4	3/4	3/4	3/8	101.25
NT-7	13/16	7/8	1	7/16	196.87
NT-8	1 1/16	1 1/8	1 1/8	9/16	322.73

Stocked in Grade ND-25



This Firthaloy Nail Die Barbing Machine in use at Pittsburgh Steel Company is familiar equipment in nearly every nail plant tool room in the country. For further information and prices on this modern aid to better production, contact your nearest Firth Sterling District Office.

R-333

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

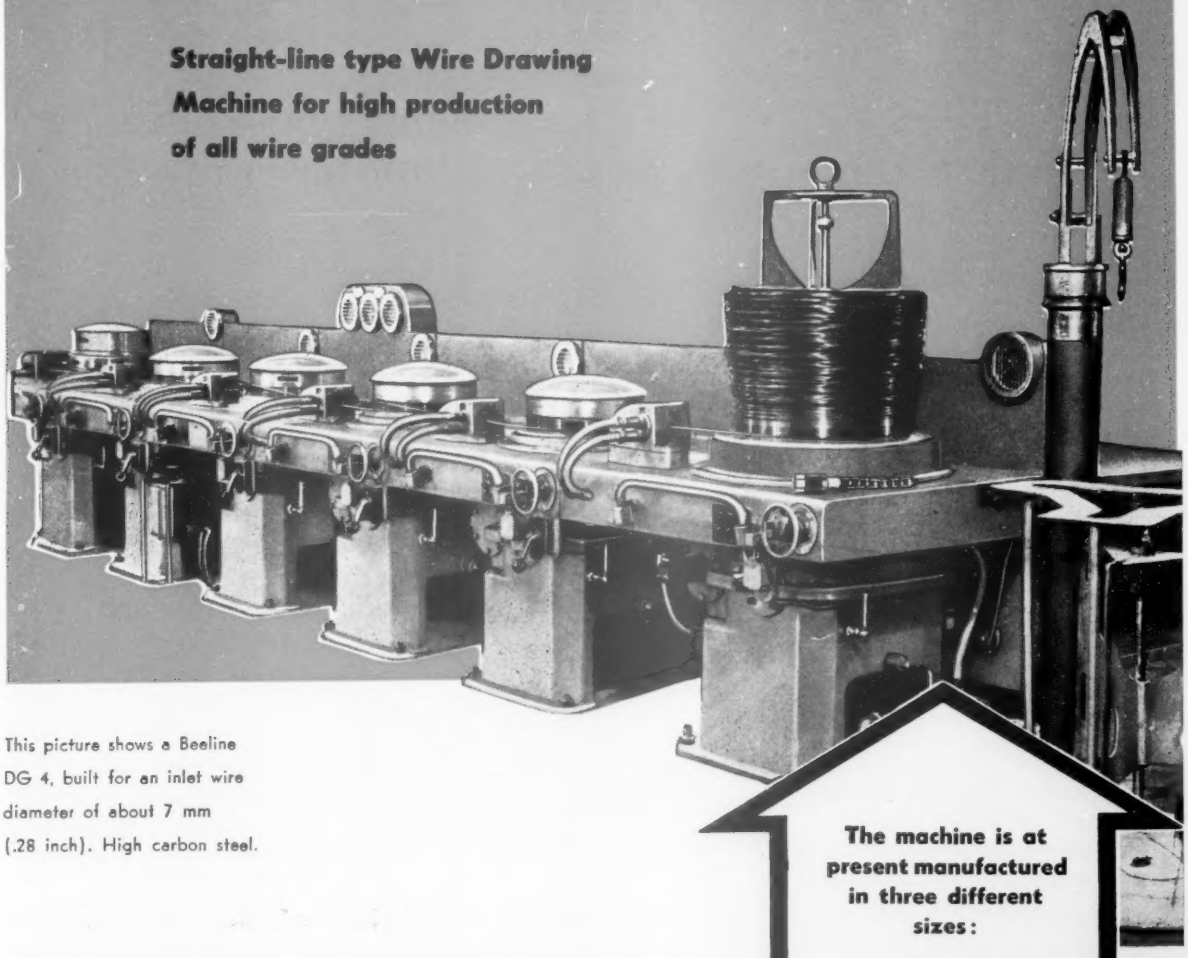
MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON, WEST HARTFORD, YONKERS
OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND* DAYTON DETROIT*
WEST HARTFORD* HOUSTON* LOS ANGELES* PITTSBURGH* WESTFIELD N.J.

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool and Die Steels
Stainless Specialties
High Temperature Alloys
Zirconium
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets

THE BEELINE WIRE DRAWING MACHINE

Straight-line type Wire Drawing Machine for high production of all wire grades



This picture shows a Beeline DG 4, built for an inlet wire diameter of about 7 mm (.28 inch). High carbon steel.

Prominent Beeline features:

- Complete absence of slipping between wire and block.
- Direct block-to-block wire running, with automatic speed control and no loops or other mechanical adjusting devices.
- Continuous speed adjustment from almost zero up to maximum.

Let us help you solve your problems. We shall be glad to answer your questions promptly. Don't forget to let us know what wire is to be drawn, the inlet and finished diameter, its intended use, the production required, and all other relevant information (tensile strength of the finished wire etc.). Then we can suggest a machine that is just right for you.

The machine is at present manufactured in three different sizes:

BEELINE DG 5

for heavy wire, about 13 mm. (.500 inch)

BEELINE DG 4

for wire rods, about 7 mm. (.28 inch)

BEELINE DM 3

for wire with an inlet dia: wire of about 3 mm. (.116 inch)

MORGÅRDSHAMMAR

MORGÅRDSHAMMARS MEK VERKSTADS AB • MORGÅRDSHAMMAR • SWEDEN

Cables: Morgårdshammar, Ludvika. Tele: 0240–71100

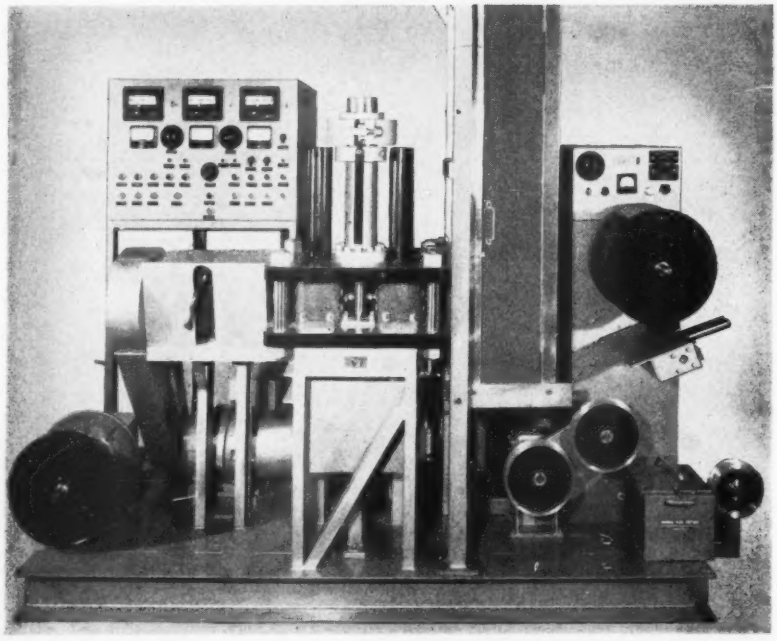
ANNOUNCING • • •

A NEW TEFLON* EXTRUDER

This completely new extruder for insulating wire with Teflon* resins is now in production and available

IT FEATURES:

- HIGHER PRODUCTION SPEEDS, PRODUCING QUALITY WIRE.
- MAINTENANCE AT A VERY MINIMUM.
- INTERCHANGEABLE CYLINDER FOR CHANGE FROM 1½" to 2½".
- ALL DRIVES ELECTRONICALLY CONTROLLED, WITH NEWLY DESIGNED ELECTRICALLY CONTROLLED TENSION PAY-OFF.
- STEPLESS RANGE OF HEATING IN OVENS BY USE OF REACTORS, OVENS REACHING OPERATING TEMPERATURE IN A FEW MINUTES.
- DOUBLE SCREW RAM TO PREVENT LEAKAGE OF NAPHTHA IN SCREW JACKS AND TO SUPPLY MORE POWER.
- GUIDE TIP ADJUSTMENT BY MEANS OF A ½" ROD TO ELIMINATE POSSIBLE BUCKLING OF THE TUBE.



There can be no lost motion, nor are extra steps necessary, since the Master Control Panel (see upper left in picture) is readily available to the operator for any adjustments that may be required during the extruding process.

The extruder is completely wired—just connect to the power supply and it is ready for operation. It is also equipped with a DAVIS Spark Tester to locate dielectric faults without breaking fine wire. This means that there will be NO necessity for re-stringing the wire.

Write for complete details or telephone for an appointment (COlony 9-3359) to see this Teflon* Extruder in operation.

* Registered du Pont Trade Name.

DAVIS ELECTRIC CO.
WALLINGFORD, CONNECTICUT

DAVIS WIRE & CABLE EQUIPMENT

DUAL and SINGLE TAKE-UPS • PAY-OFFS • CAPSTANS
SPARK TESTERS • RE-SPOOLERS
RAM-TYPE TEFLON EXTRUDERS

FORMVAR® . . .
for a balance of properties

You get more for your magnet wire dollar when you buy wire coated with FORMVAR phenolic enamel. You get a balance of mechanical, electrical and chemical properties unequalled in the industry . . . plus more than 15 years of proven performance as the industry standard. That's why FORMVAR phenolic enamel is used on more than 70% of all magnet wire.

FORMVAR phenolic enamelled wire possesses excellent wet and dry dielectric properties, exceptional adherence, flexibility and elongation, and outstanding resistance to heat shock, abrasion, solvents, acids and bases.

FORMVAR is the registered trademark for polyvinyl formal produced and sold only by Shawinigan Resins Corporation. When combined with an alkyl phenolic resin it becomes that tough, heat resistant wire enamel you may know as FORMVAR enamel.

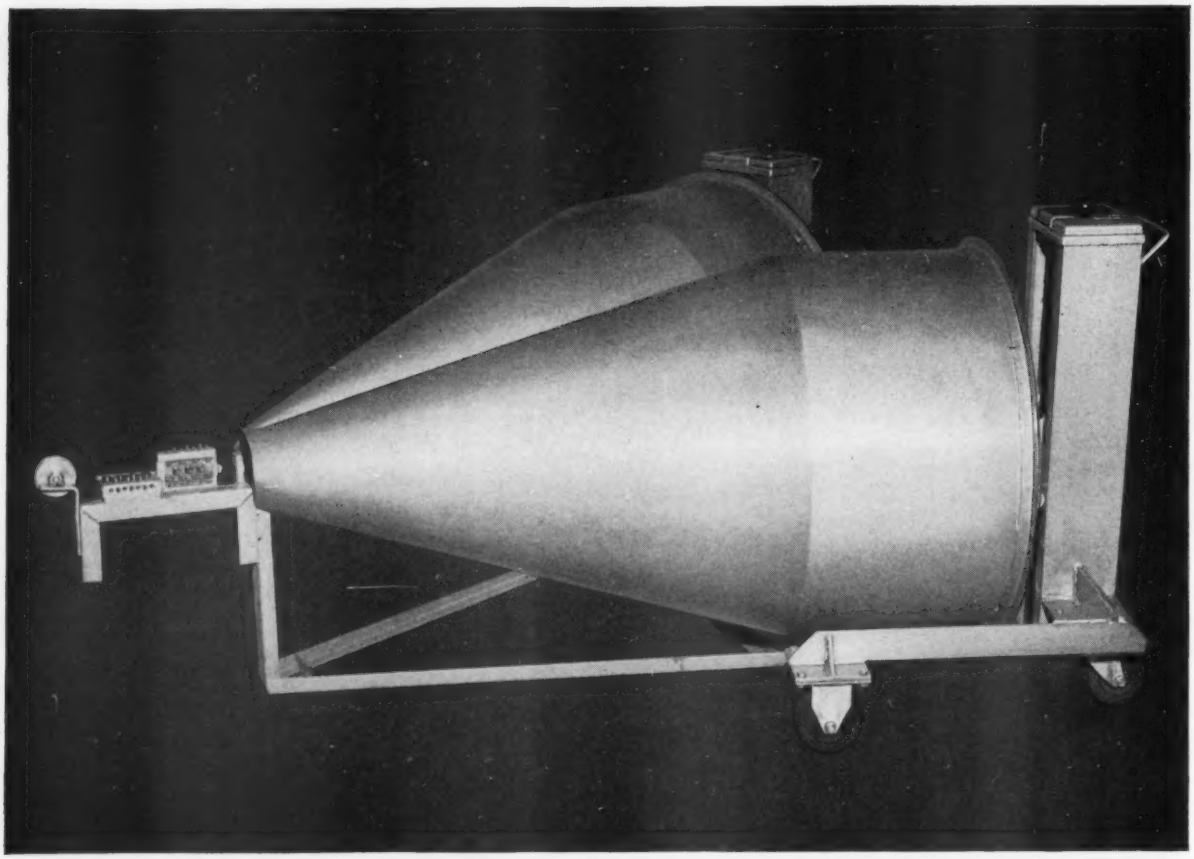
If you want an insulation which will permit trouble-free service, lower maintenance and production costs, and greater efficiency, look to FORMVAR. Shawinigan's exacting production controls and active applications research keep FORMVAR a uniform and dependable ingredient for magnet wire enamels. Shawinigan Resins Corporation, Department 5311, Springfield 1, Mass.

FORMVAR® polyvinyl formal

for wire enamels by

SHAWINIGAN RESINS

21 SATISFIED CUSTOMERS SINCE OUR MAY INTRODUCTION OF OUR CONTINUOUS DUAL FLYER PAY-OFF



Step Up Your Extruder Line Capacity, Simplify Reel Handling Problems With This New High Speed Unit.

Your extruder line operation will reach a new high in speed and efficiency with the new Entwistle Dual Flyer Pay-Off. This new unit enables continuous pay-off of wire in speeds in excess of 3500 FPM, reel weights up to 1500 lbs., and wire sizes down to No. 26 A.W.G.

Switch-over to the second reel is accomplished automatically through a polished steel opening in between the hoods. Braking of reels and all inertia problems are non-existent with this type of pay-off. Dual hydraulic reel trucks make loading and unloading of reels a much simpler operation.

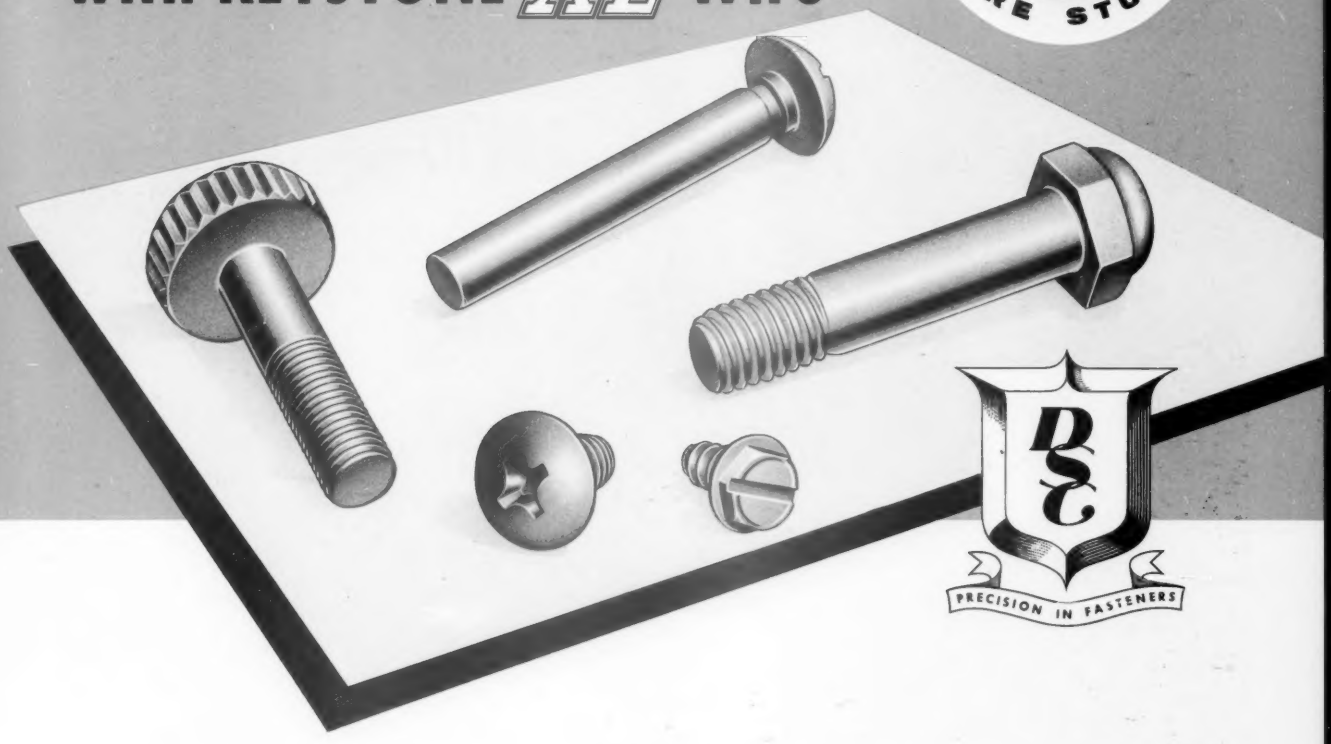
Find out what the new Entwistle Dual Flyer Pay-Off can do for your extruding operations. Write or phone for complete details.

You may now complement this with our new unit adjusted wire straightener available in two sizes.

ENTWISTLE
Manufacturing Corporation
1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND

Dorson Screw Company sets high quality standards with KEYSTONE XL Wire

KEYSTONE XL WIRE STUDY



Talk to Chester S. Dorch, president and partner in Dorson Screw Company, 2509 West Cermak, Chicago, about cold heading with Keystone "XL" Wire—here's what he'll tell you:

"Our business reputation is based on ability to produce high quality sheet metal and machine screws as well as non-standard and highly specialized parts at a competitive price. Keystone "XL" Wire has been a major factor in helping us meet these standards."

An important reason why Dorson, like other progressive fastener manufacturers, has eliminated rejects, increased die life and has cut costs, comes from the *flowability* of Keystone "XL" Wire. This inherent characteristic of Keystone "XL" Wire makes it possible to produce extreme upset head fasteners of highest quality.

Unique, as well as standard screws like those manufactured by Dorson and shown above, become high-speed production items when Keystone "XL" Wire is used. Your Keystone Wire Specialist, backed by a skilled metallurgical staff, will be pleased to assist you in solving your cold heading problems. He will show you how the uniform high quality of Keystone "XL" Wire costs no more—yet means much more in the long run.

Keystone Steel & Wire Company
Peoria 7, Illinois

Brand New . . . COLD HEADING FACTS FOLDER . . . send coupon today! New folder discusses uses, applications, methods, technical facts, wire requirements.

Name_____ Title_____

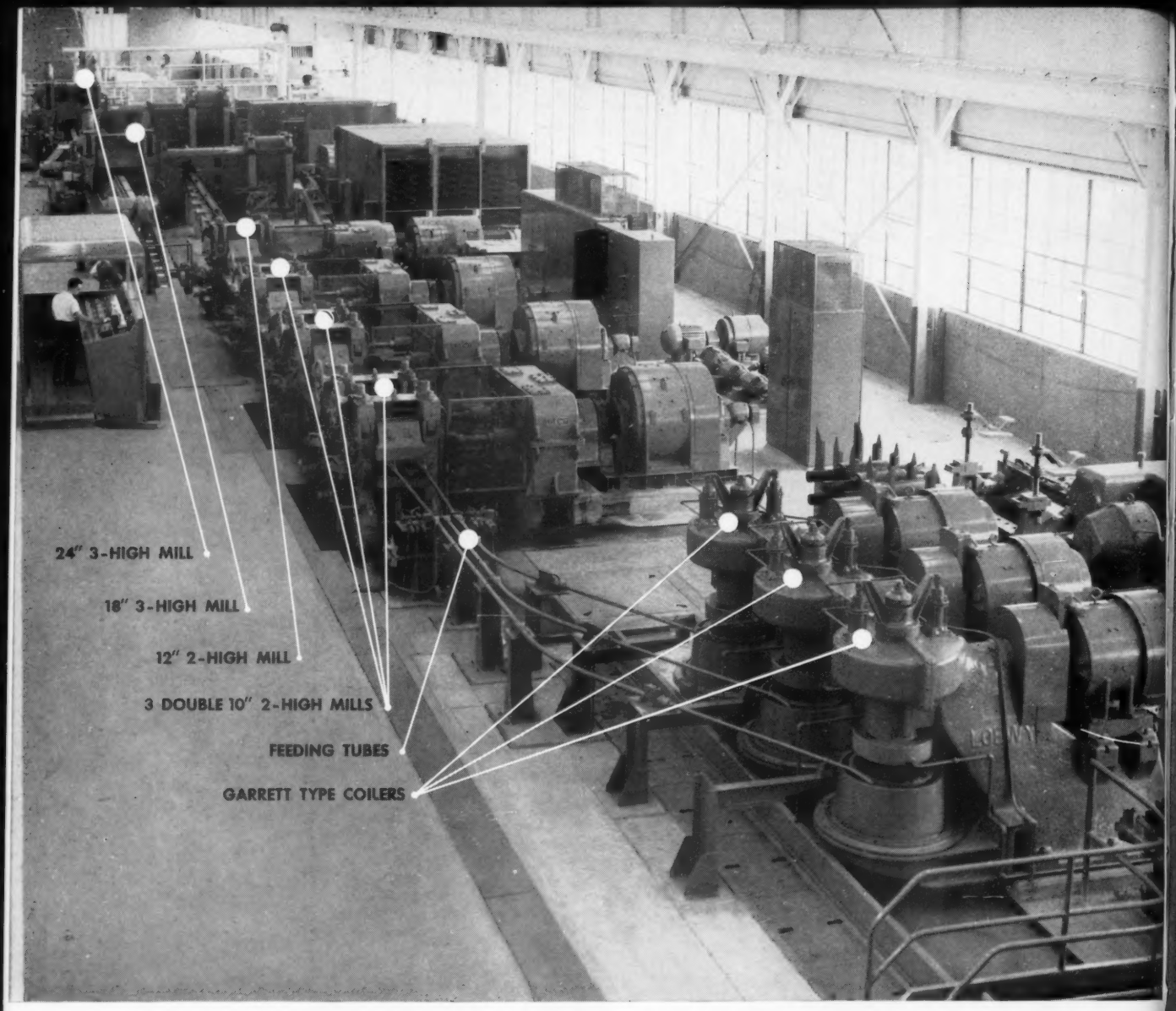
Company_____

Street_____

City_____ State_____

Keystone Steel & Wire Company, Peoria 7, Illinois

KEYSTONE
WIRE FOR INDUSTRY



This installation has a capacity of 40,000 lbs per hour for 2-strand rolling with finished coil delivery every 19 seconds.

new Loewy copper wire rod mill reduces wire bars to 5/16" wire rod, automatically

At the plant of a leading manufacturer of electric cable, this new Loewy mill is rolling 5/16" and 7/16" copper wire rod from standard wire bars in a continuous, fully automatic operation.

The mill consists of two 3-high roughing mill stands, seven continuous finishing stands and three Garrett coilers. Copper wire bars are conveyor-fed into the furnace. After leaving the furnace the ingots are rolled down in 14 passes to finished size. Leaving the last stand at a speed of 2400 FPM the wire is coiled. The coils are tied and conveyed into a pickling line. The entire procedure is automatic and all operations are controlled from one operator pulpit.

Like this high-speed wire rod mill, all Loewy equipment is designed to produce more, in less time, at lowest cost. We design, build and install blooming and slabbing mills, plate mills, structural and rail mills, bar and skelp mills, continuous billet and strip mills for ferrous and non-ferrous metals as well as high-speed foil mills. For illustrated bulletin 14002, write Dept. 170, Loewy-Hydropress Division, BLH Corporation, 111 Fifth Avenue, New York 3, N.Y.

BALDWIN BLH LIMA-HAMILTON

LOEWY-HYDROPRESS
BALDWIN-LIMA-HAMILTON

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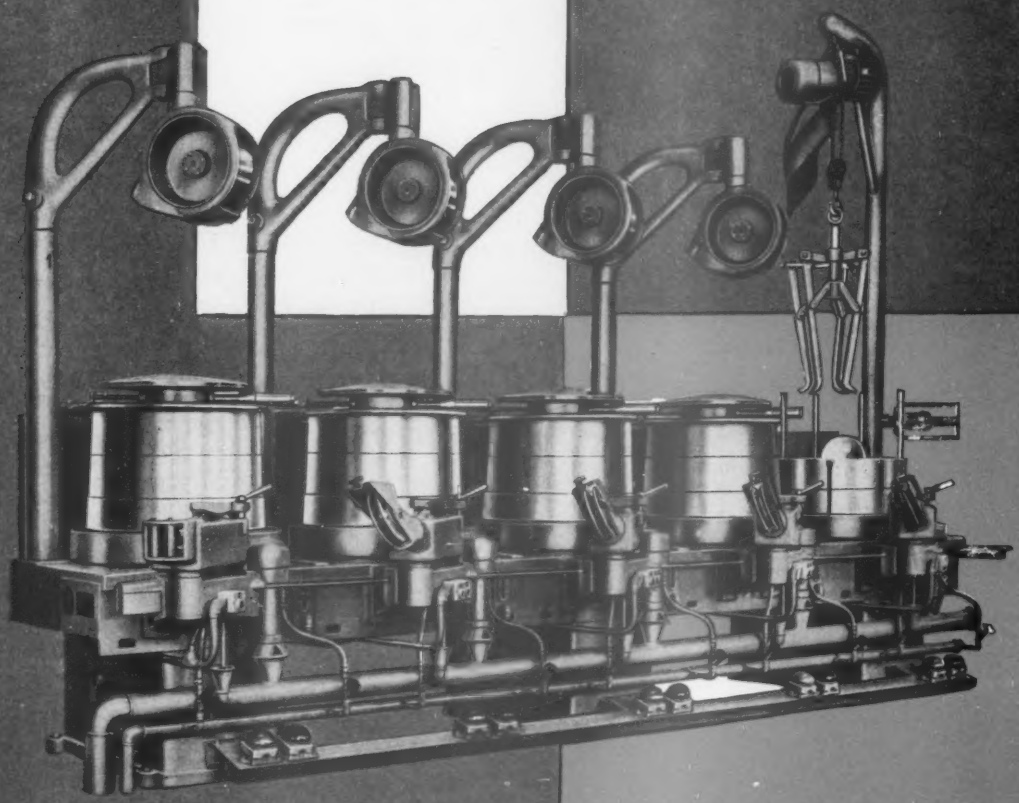
HERBORN

Non-Slip Wire Drawing Machines



WITH THE APPROVED INDIVIDUAL MOTOR DRIVE FOR EACH BLOCK

Please send your inquiries to:

MASCHINENFABRIK HERBORN BERKENHOFF & DREBES A.-G. **HERBORN/DILLKREIS** GERMANY

Sole Representative in the U.S.A.: **KURT ORBAN CO., Inc., 34 Exchange Place, Jersey City 2, N. J.**

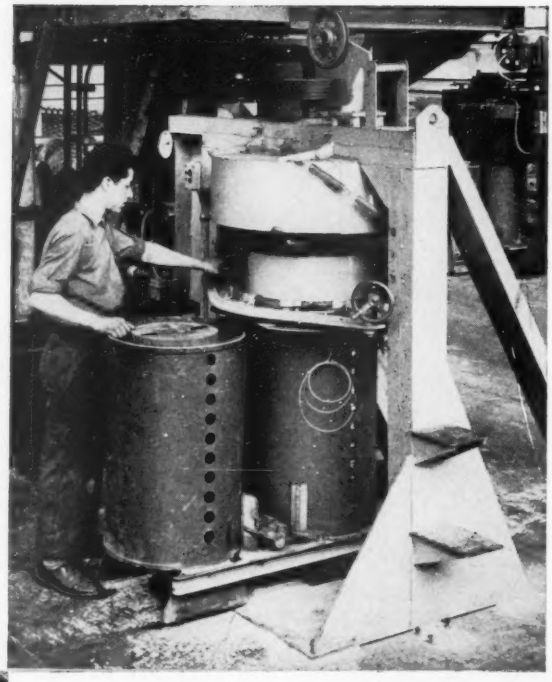
4.800

feet per minute

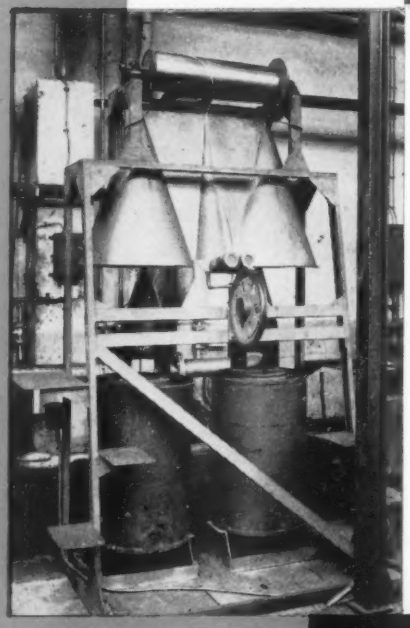
is the speed never reached before of the new continuous

Godderidge

Packaging Unit



Take-up device on a wire-drawing machine.



Double high-speed Pay-Off Stand

OUTSTANDING FEATURES :

- Range of diameter: from 8 to 24 B & S
- Changing of drums at full speed
- Diameter control possible whilst running
- Both-ends of wire accessible, therefore welding and continuous supply of high speed extruders possible by new double

PAY-OFF STAND

For further details write to

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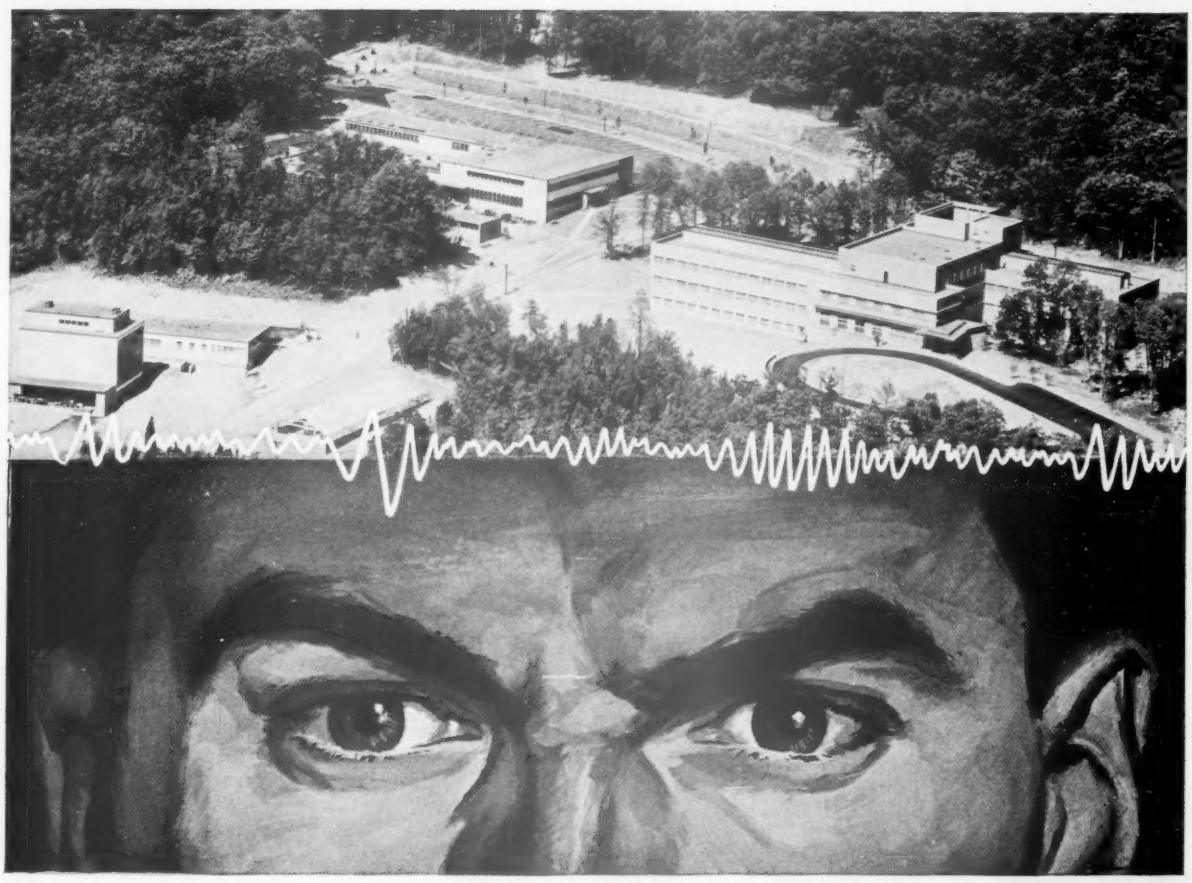


Here, creative minds will shape the future

Yes, here in the new Research Center of United States Rubber Company the probing minds of chemists and other scientists will find the ideal environment for conceiving new ideas...the finest facilities for bringing them into reality. Located on a 100-acre tract in suburban Wayne Township, New Jersey, the Center is a concrete symbol of the basic importance of Research in this company's past, present and future.

Significantly, at least 25 of U. S. Rubber's major product lines have been developed within the past twelve years.

As the Chemical Division of U. S. Rubber, Naugatuck Chemical continues to contribute a generous portion of new and improved products . . . such as Naugapol® styrene-butadiene polymers specially processed for minimum moisture content.

Such developments stem not only from our research laboratories at Naugatuck, but also from Naugatuck's agricultural research facilities at Bethany, Connecticut, and the laboratories of our Canadian affiliates, Naugatuck Chemicals and Dominion Rubber Company, Ltd. Now, Naugatuck's research will be substantially augmented—and perhaps channeled in radically new directions—by the more fundamental research carried on at the new Research Center.

In the future, even more than in the past, look for the name Naugatuck to identify *the newest and the finest* products in their respective fields!

Naugatuck Chemical

Division of United States Rubber Company, Naugatuck, Connecticut

Rubber Chemicals · Synthetic Rubber · Plastics · Agricultural Chemicals · Reclaimed Rubber · Latices · **CANADA:** Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario · **CABLE:** Rubexport, N.Y.

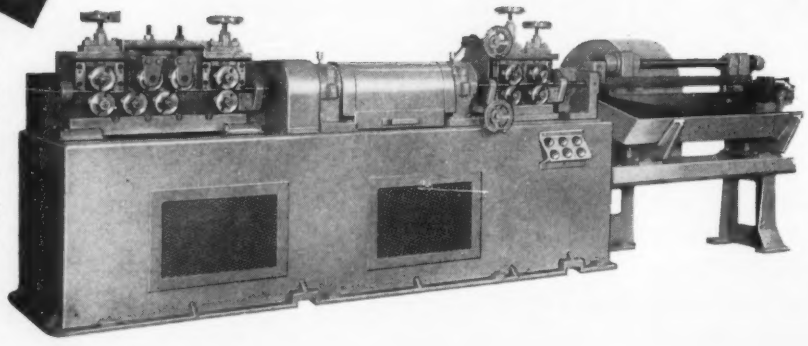
Famous names and Precision Manufacture make

SHUSTER

Wire Straightening and Cutting Machines your BEST BUY!

Illustrated **MODEL 3AV**
¼" to ½" basic wire,
feeds from 76 to 228
feet per minute.

MODEL 4AV
⅜" to $1\frac{1}{16}$" basic wire.
feeds from 90 to 180
feet per minute.



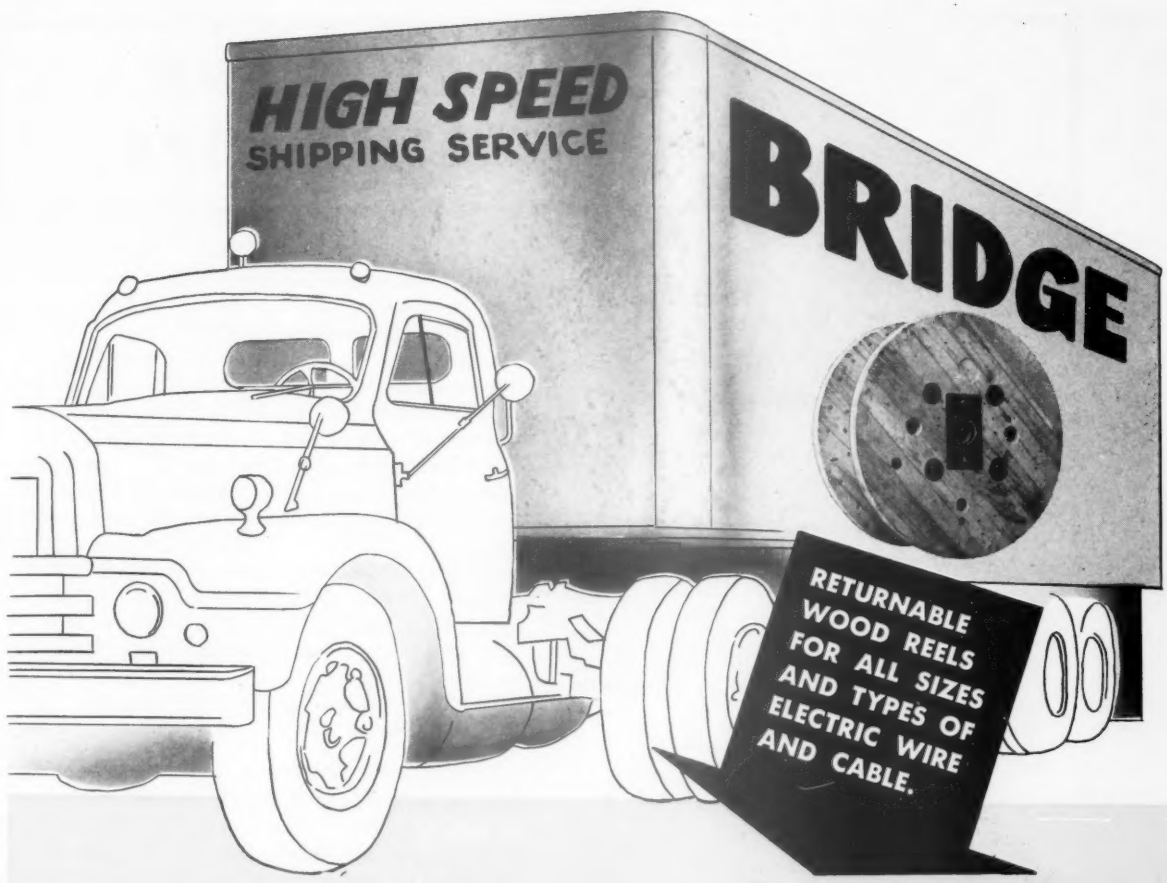
Only the *finest* components are used in the precision manufacture of Shuster Machines: Micro-Switch trips new improved target with positive setting and release; National Acme solenoid operates Hilliard roll type clutch; Warner electric brake; two Reeves variable speed units control speed of cut and range of feed; alloy steel feed roll shafts run on Timken bearings.

All these fine Brand Names are represented in the Shuster 3AV — 4AV illustrated. **There is a Shuster to fit your requirements from .020 to 11/16".**

Send for free wall size split gauge wire chart from 41 gauge to 7/0.

METTLER MACHINE TOOL, INC.

155 W. Adeline, New Haven, Connecticut

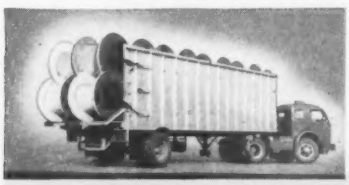


EVERY TYPE OF WOOD REEL—

Returnable or Non-Returnable for the WIRE INDUSTRY . . . from 10" to 10' in diameter.

STRAIGHT LINE production methods produce accurately-made REELS of HIGHEST QUALITY at prices that make it good business to buy from BRIDGE.

A completely MODERN plant, with the very FINEST and FASTEST equipment, much of it specially designed for BRIDGE, assures you of rapid SERVICE and STRONG SERVICEABLE REELS.



HIGH SPEED
SHIPPING SERVICE IN OUR OWN TRUCKS

within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

RETURNABLE REELS ARE BUILT TO PROVIDE MANY TRIPS WITHOUT REPAIRS.

"REEL GOOD . . .

Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"

U.S.I.

Vol. II, No. 6

POLYETHYLENE PROCESSING TIPS

RESIN PROPERTIES THAT AFFECT STRESS-CRACK RESISTANCE OF POLYETHYLENE

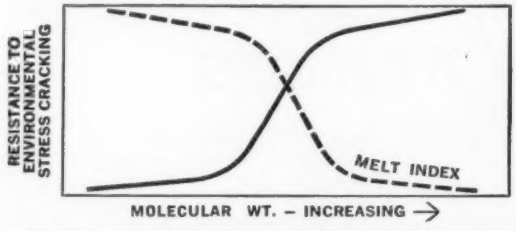
Environmental stress cracking is the term used to describe a certain type of material failure. With polyethylene this failure occurs when the plastic is under high local stress (either external or internal) and in contact with materials such as a soap, detergent, or solvent, which affects the polymer.

Resistance to stress cracking is especially important for applications such as electrical insulation, polyethylene pipe, housewares, and certain types of packages.

Two factors influence the resistance of a polyethylene part to environmental stress cracking: the resin used and the conditions used in fabricating the part.

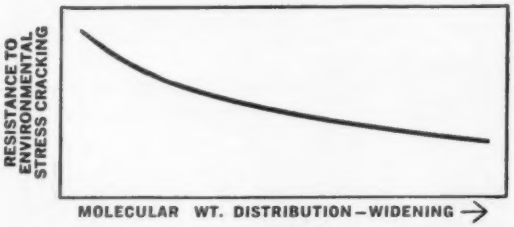
Which resin to use:

Stress crack resistance is greater with a resin of ***higher molecular weight*** – that is, lower melt index.



Then why not use low melt index resins? Because production rates are lower. The processor must make a compromise between peak production rate and top stress-crack resistance and use a resin that will be satisfactory, if not ideal, in both respects.

Molecular weight distribution of the polyethylene



resin is important too. Resins with a narrow molecular weight distribution (with fewer molecules much higher or lower than the average) have better stress crack resistance than those with wide molecular weight distribution (more of the larger and smaller molecules but the same average). The low molecular weight fraction is more susceptible to attack by environmental materials.

However, the flow properties of a polyethylene resin having a narrow molecular weight distribution and a given melt index are not as good as those of a polyethylene resin having a wide molecular weight distribution and the same melt index. Here again the processor must make a compromise between production rate and the properties he requires in the end product.

Density of the resin will also have an effect on the resistance of that polyethylene resin to environmental stress cracking. The higher the density, the poorer resistance to environmental stress cracking. On the other hand, the more linear or more dense polyethylenes have enhanced flow properties and higher stiffness and tensile strength.

There is no single answer to all problems

It is obvious from the preceding discussion that there is no simple solution to the selection of a resin for a particular end use. The resin must be carefully selected while giving proper consideration to the important end properties required in the fabricated article.

An answer to your particular problem can be found by obtaining a polyethylene resin from a manufacturer who can give you the balance of properties required – high or low melt index, narrow or wide molecular weight distribution, a range of densities. U.S.I. is one such supplier and their Technical Service Representatives stand ready to assist you in the selection of the proper Petrothene resin.

Processing conditions affect stress crack resistance

Processing temperatures, cooling rates, and other processing conditions can have a marked effect on stress crack resistance, because of residual strains left in the fabricated article.

There isn't room to go into these in detail here but the next issue of "Tips" will discuss them more fully.

Meanwhile if you have a specific problem, call on U.S.I.'s Technical Service Engineers. They will be glad to work with you toward finding a solution.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

New Life for old wire furnaces

Rebuilding outmoded furnaces—adding high input "O" tubes and high velocity circulation systems—increases the average wire annealing production by at least 40 percent, with no increase in floor space requirements.

Lee Wilson engineers have developed a wire furnace modernization program that will bring your old furnaces up to date quickly at a minimum of expense.

Why not look into the Lee Wilson plan. The details are available by contacting the Lee Wilson representative in your area or writing direct.

Lee Wilson* **ENGINEERING COMPANY, INC.**

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HIGH CONVECTION ANNEALING FURNACES

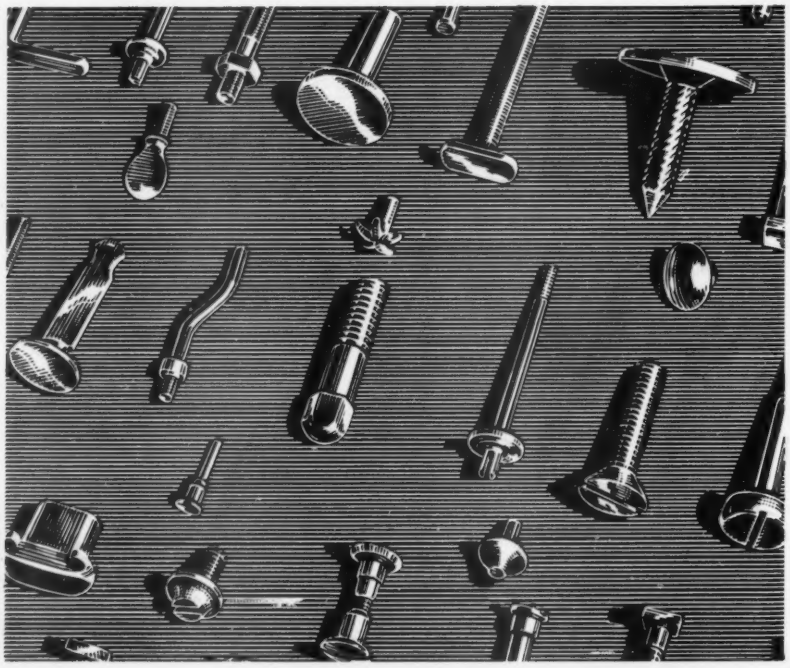
MAKE THE BEST METALS BETTER

*ORIGINATORS AND LEADING PRODUCERS OF HIGH CONVECTION ANNEALING FURNACES

5975

The superior ductility of Chase wire makes forming easier on big-head screws or rivets.

Chase makes wire



THE CHASE WIRE SERVICE MAN, W. F. Schmollinger, our wire mill superintendent, heads our team of experts... spends his time solving *your* problems. Often in the field, working with engineers and shop foremen, he has helped many manufacturers of cold-headed parts to make a finer product!

This **BOLT** requires high-strength wire!

High-strength Chase wire for square and hexagonal head bolts makes a finer quality product.

This **WOOD SCREW** requires "in-between" wire!

Some items, like wood screws, call for wire with both high strength and ductility.

to fit your product!

WHAT DO YOU NEED IN WIRE?

Ductility? High strength? Perhaps a certain amount of both? Chase makes a variety of alloys and tempers, to meet most every production requirement. But if Chase doesn't already make it, we'll *product-engineer* wire for your individual needs!

It's a unique Chase service! Although Chase wire is quality-controlled and free from imperfections, even the best wire can't do a perfect job unless it's the right alloy and temper for *you*.

So before you order wire again, get in touch with Chase. Tell us just what you do with wire ... what properties you look for ... describe any problems you may be having. Send us samples or drawings of your product. By studying your individual requirements, trained Chase technicians can help you gain greater efficiency and economy in production.

Contact the Chase Wire Service Man through the warehouse or office nearest you!

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The Nation's Headquarters for Brass, Copper and Stainless Steel

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With

NOPCO® KLY

a liquid fine wire drawing lubricant

Be sure to try Nopco KLY next time you're drawing fine size steel or fine and intermediate size copper wire. It's *different*—and everything different about it you'll find is a big advantage.

First, this emulsifiable oil mixes quickly and completely with water—hot or cold. This feature alone is enough to make it ace-high with you. But it has other advantages equally important.

Your bath lasts longer. Nopco KLY has a built-in affinity for water. Its lubricants stay *uniformly active* much longer, since the "drag out" of the lubricants from the solution is reduced beyond anything you've ever seen.

Prevents Formation of Insoluble Copper and Lime Soaps—both the copper soaps, which score dies, clog feed lines and screens; and the lime soaps you've been bothered with when drawing lime coated steel wire.

KLY may be used for high carbon, low carbon, limed, galvanized, and liquor finished fine steel wire—also for fine and intermediate copper, bronze, and brass wire. You'll surely want to try this die-saving, cost-saving lubricant soon. Write today for free booklet "Nopco KLY", which gives full instructions, lists percentages of fat in all emulsions.
Nopco Chemical Company,
Harrison, N. J.

YOU MIX IT FASTER, EASIER

YOUR BATH LASTS LONGER

YOU GET UNIFORMLY ACTIVE LUBRICATION

1907–1957 50 Years OF PROGRESS IN CHEMISTRY

NOPCO

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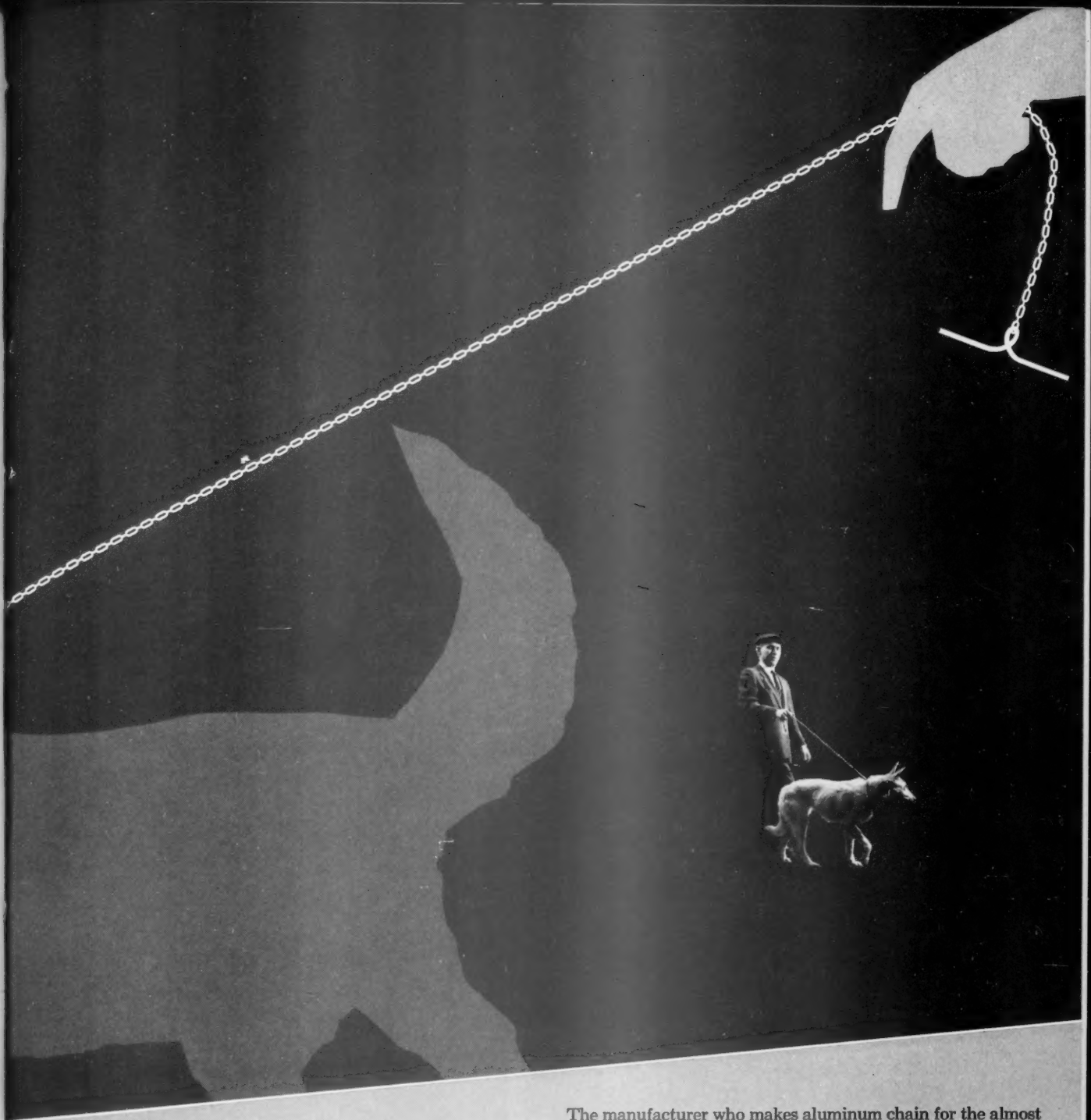


a profitable idea!

The manufacturer who makes aluminum chain for the almost 50 million dogs and cats in the country is sure to win the business of millions of pet owners. A leash or "lead" of aluminum is light weight, rust-free, strong, and can be anodized in beautiful colors. No matter what your wire product, it will pay you to check into the advantages of aluminum.

Alcoa has set up a special department to work with you on profitable new ideas, new uses for aluminum wire. For immediate action, write ALUMINUM COMPANY OF AMERICA, Wire Products Development, 875-L Alcoa Bldg., Pittsburgh 19, Pa.

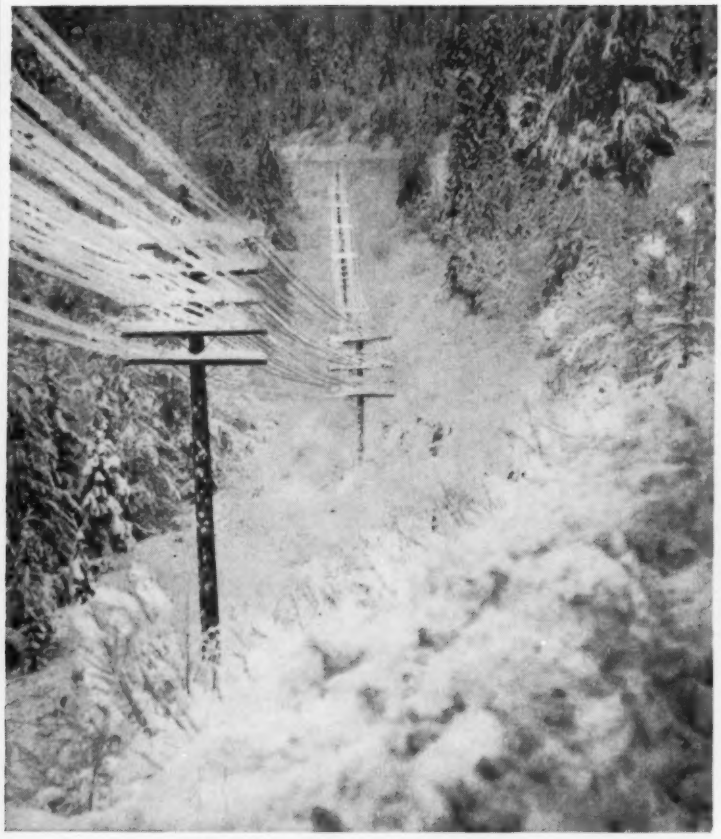
Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM WIRE PRODUCTS

NEW! "ALCOA THEATRE" • Exciting Adventure • Alternate Monday Evening

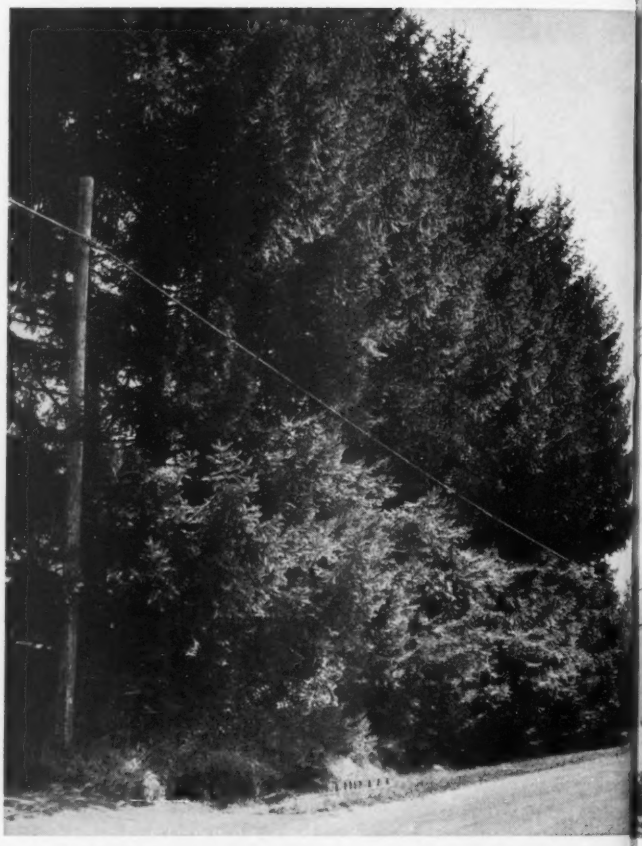
Telephone installations show...

How Polyethylene performs in the field



WASHINGTON – Polyethylene-covered cable was first installed in this mountainous region of the Pacific Northwest in 1950. Field experience showed that it was adaptable to any method of hanging and required no special equipment. Installation could be made on existing pole arms without increasing crossarms, pole height, or tree trimming.

The line has withstood extremely heavy snow and ice loading in certain mountain and valley sections. There has been no deterioration despite temperatures 40 deg. below zero. During the summer months, temperatures up to 115 deg. and exposure to sunlight have had no discernible effect.



NEW YORK – Recently, 33,000 feet of cable and 75,000 feet of wire, both insulated with polyethylene, were put into service in upstate New York. Although an unusually large number of thunderstorms were experienced during the year, no lightning damage was reported on these lines. To date, rain conditions have had no effect.

Much of the cable was strung on existing poles, but in the construction of new lines it was found practical to use ⅓ fewer poles. The need for crossarms and tree trimming was also reduced. As a result, maintenance costs in rural areas have stayed low.

YEARS of service under a variety of terrain and climatic conditions are represented by these field reports from the telephone industry. They describe the performance of BAKELITE Brand Polyethylene used as jacketing and insulation for wire and cable.

In every instance, BAKELITE Polyethylene has brought improvements over conventional materials. Its superior moisture resistance has set a new standard in trouble-free operation. Its extremely light weight has saved time and expense in installation. Its toughness has made cable handling easier. Its excellent dielectric strength has far exceeded the needs of telephone service.

The growing acceptance of this material is shown by its use in coaxial cable and signal control cable as well as telephone line wire. BAKELITE Polyethylene satisfies REA requirements for plastic-covered telephone wire, IPCEA specifications for power cable, ASA standards for weatherproof wire, ASTM D1238-52T Type II, dielectric materials, and IMSA specifications for fire alarm and signal control cable. For more information, write Dept. AT-196.

BAKELITE
BRAND
POLYETHYLENE

UNION CARBIDE

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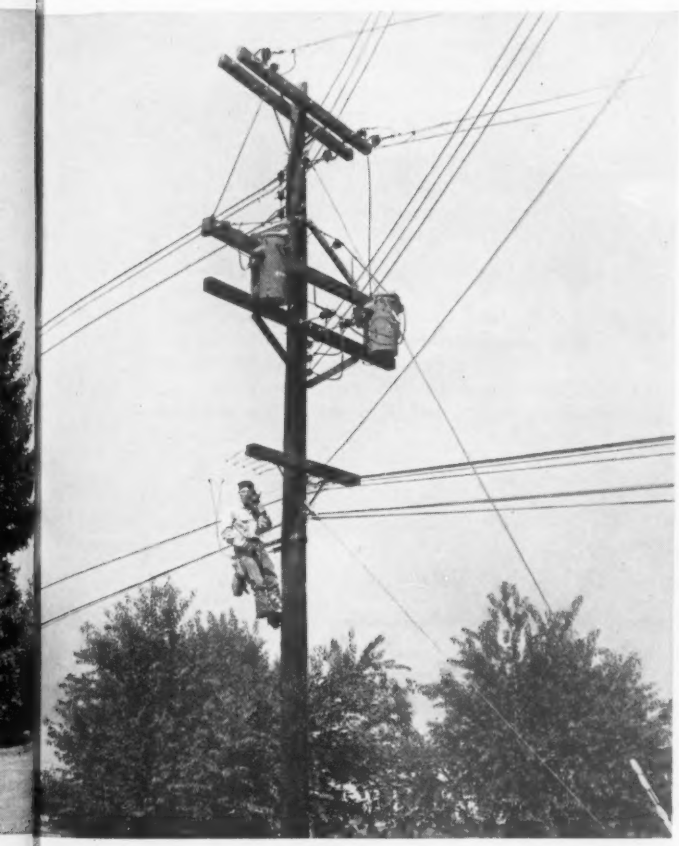
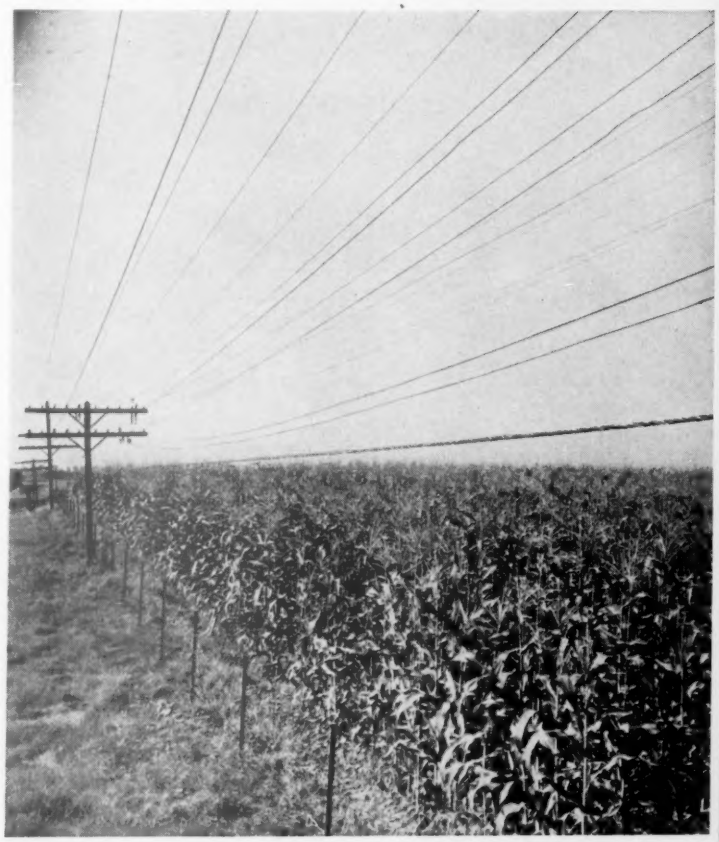


PENNSYLVANIA – Polyethylene has stood up under exhaustive indoor and outdoor tests carried out in western Pennsylvania during the past year. It has effected such savings in installation costs that it will be a major item in purchases for the coming year.

With respect to service life and safety, polyethylene is considered an outstanding improvement over other materials. It has shown unusual resistance to weather and abrasion. Its extremely light weight permits a smaller cable construction that is easier to handle, making for faster installations. It also permits wider pole spans, with a consequent saving in poles and maintenance.



ILLINOIS – Cable with polyethylene insulation and vinyl plastic jacketing has been used in Central Illinois since 1953. Its light weight has resulted in a 5-ft. reduction in pole height, elimination of guy wires and messengers, faster handling of cable, and wider spacing of poles.

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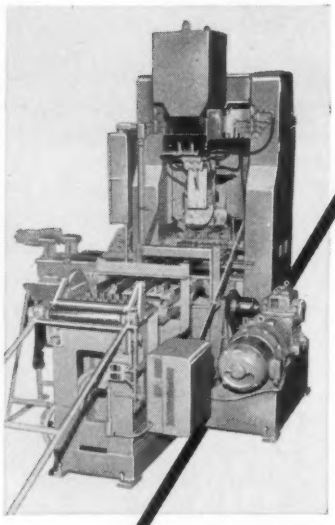

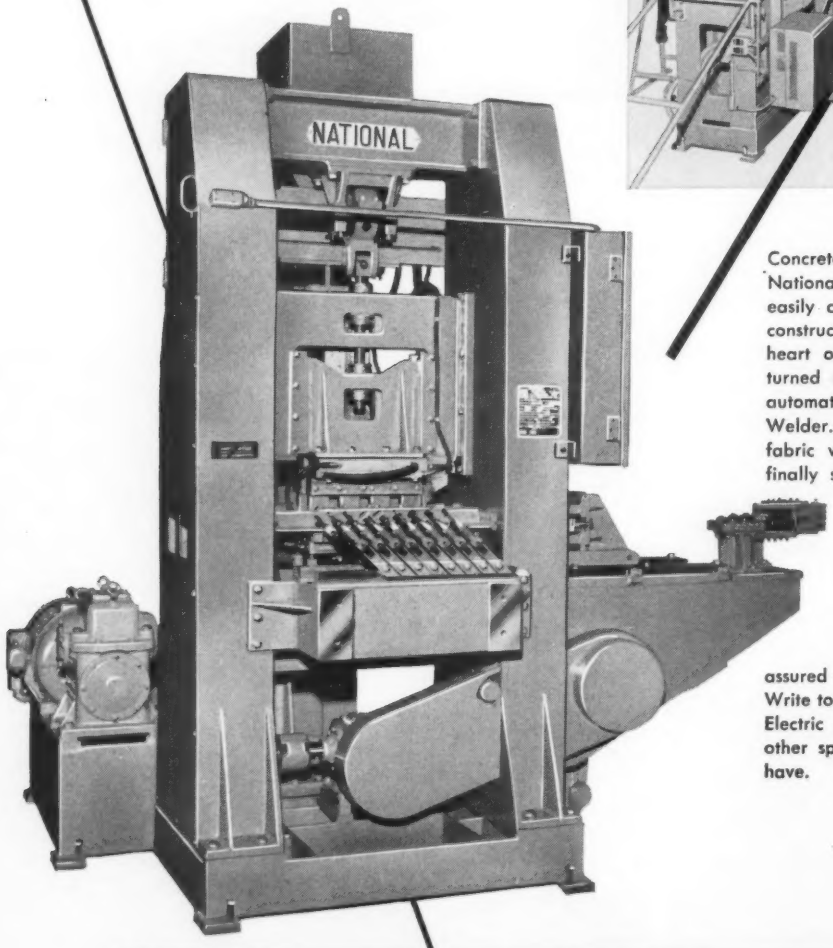

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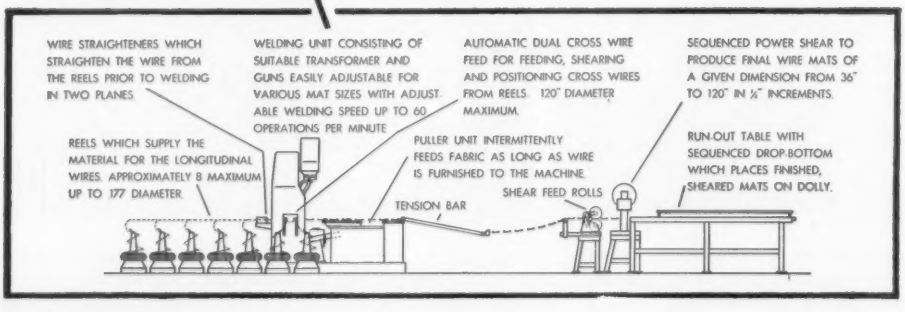
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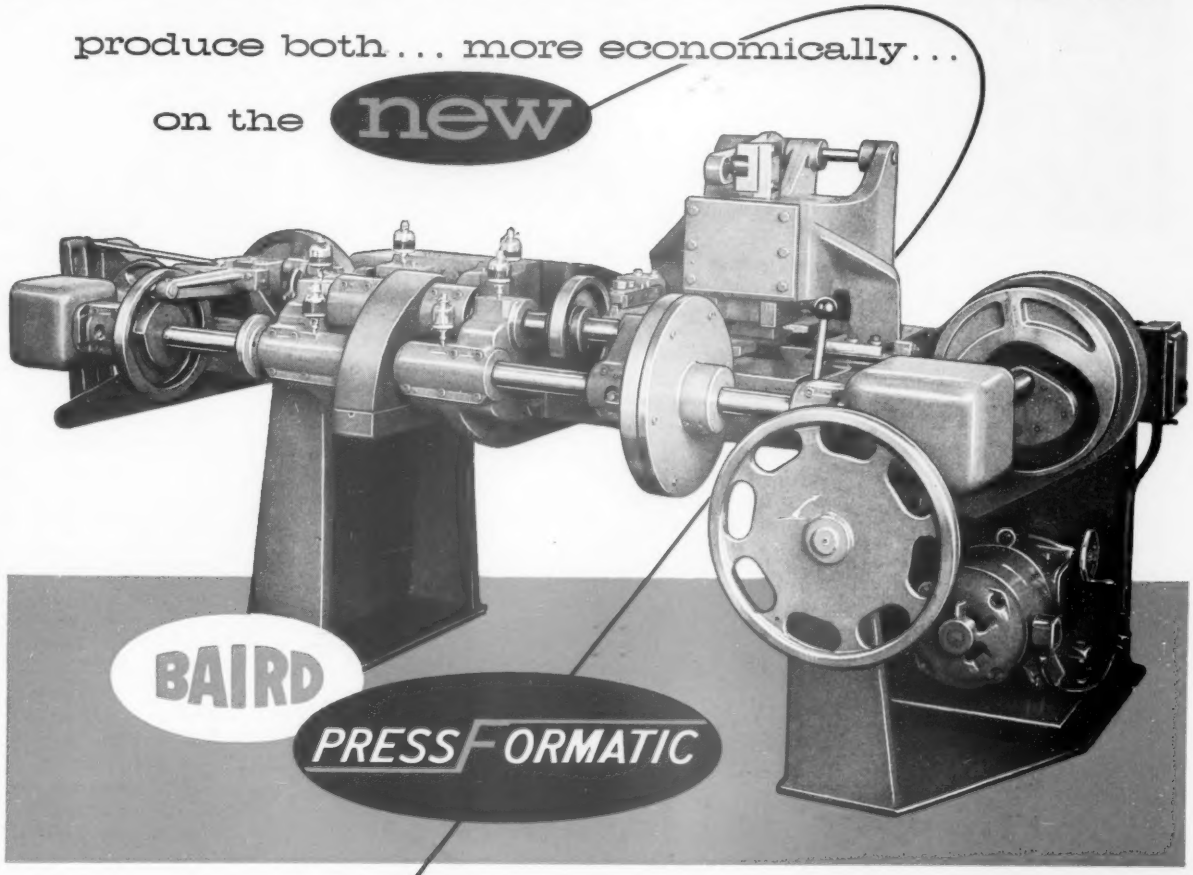

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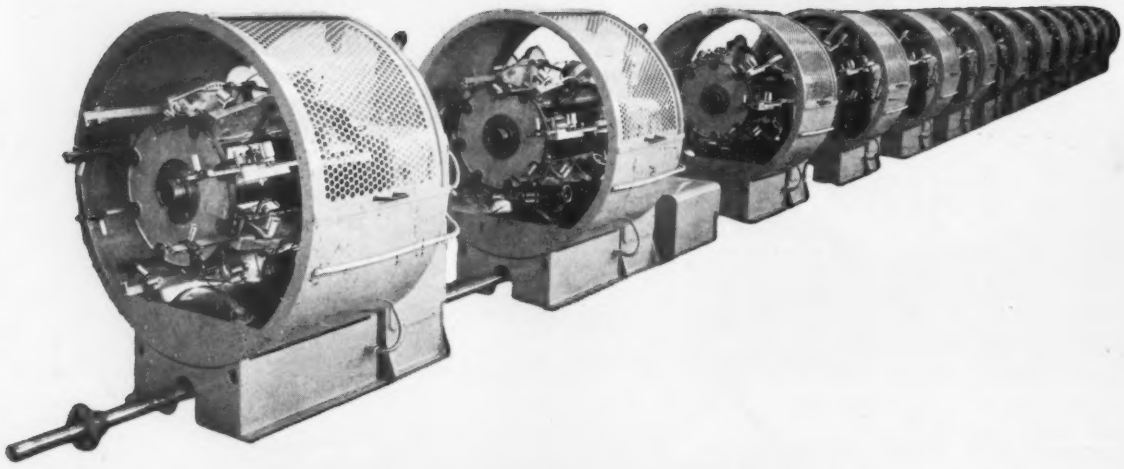

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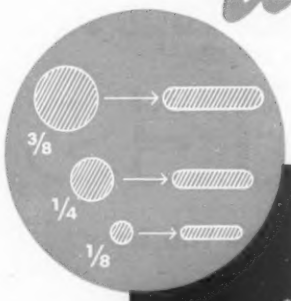

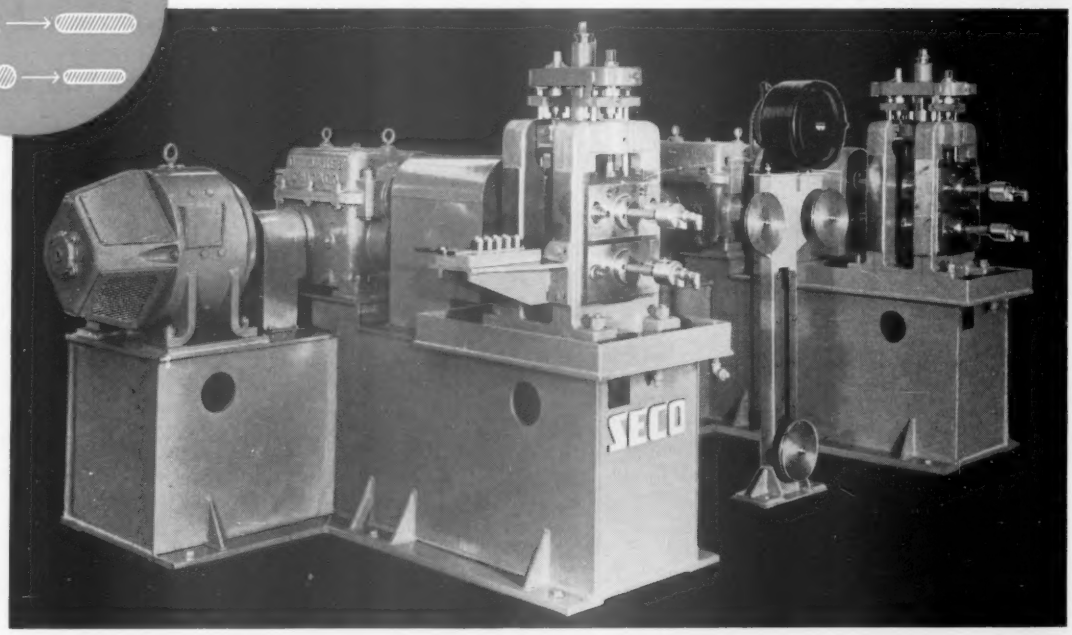

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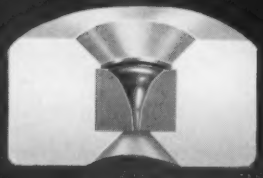

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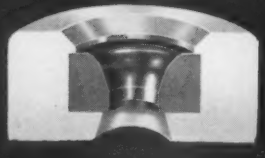

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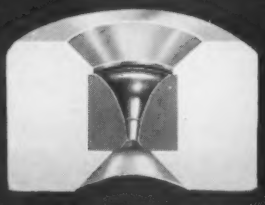

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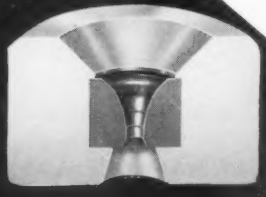

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The Wire Outlook

While industry is setting some new records for 1957 and industrial production is above that of last year, there are spots where business is not too good and a growing sentiment that all may not be as rosy as pictured.

The gross national product will be above 1956. The first half ran at an annual rate of $432 billions, the third quarter at $435 billions and the final quarter is expected to tally at around $437 billions. This represents an increase in both dollar and unit production.

For next year most industrialists are optimistic. Construction will equal or slightly exceed 1957; steel operations, now averaging a little less than 82%, should go up; machinery, especially for replacements, will have a good year; and automobile production should exceed this year's.

Wage and salary increases this year added some $600 millions to payrolls, although factory payrolls are down. Part of the feeling of uncertainty stems from the numerous lay-offs reported, even though employment remains high. Constant improvements in labor-saving equipment have been a direct result of the inflationary influence of the higher wages demanded by labor each year.

Because profits have decreased in general and major strikes are expected in the year ahead, the stock market has been discounting the future in price declines. Most factories, too, have more goods on hand than can be moved readily.

While the tight-money policy appears to have checked the boom, more and more people are wondering and worrying about inflation. The denizens of Wall Street feel that inflation as a top billing has passed the danger point. Some business men, on the other hand, particularly in the textile, lumber, appliance and building supply industries, are now actually fearful of the possibility of a period of deflation.

Taxes may be cut a little next year, wage rates will continue to rise and in the final analysis, if business stays good, it will be a result of free spending on the part of people, since government spending is scheduled to drop somewhat—about one percent.

First quarter government requirements for steel, copper and aluminum have been cut back by 7% and for nickel alloys about 1%. Wire rod supply for the coming year will be relatively easy. Concrete reinforcing bars will enjoy an active demand as the Federal road building program gets under way, while cold finished bars will be plentiful, as will the supply of manufacturers' wire. Merchant wire will be in good supply. Wire mesh for roads will be an active item. Nails will be plentiful and woven wire fencing should show some improvement.

One way of meeting the import problem on barbed wire has been the development by one producer of a lighter gauge wire of higher carbon content that is stronger, more easily handled and that sells for somewhere close to the cheap imported product.

Wire orders are up slightly, but not enough to satisfy the producers. Automotive wire has shown a pick-up in valve spring wire, high carbon spring and fastener wire. Elsewhere, fastener orders have not built up as expected for the last quarter.

The Census Bureau reports that as of August 1st the population of the country had climbed in the preceding twelve months by more than 3,000,000, bringing the total to 171,500,000. It has more than doubled since the turn of the century.

While our steel capacity is higher this year by more than 7 million tons and another 5 million or so will be added in 1958, in the face of our steady population growth, the capacities of today will be completely inadequate in another decade. Added to this the steel consumption per capita is constantly growing. It is reported that needs of the country took only 1235 pounds per person in 1940; in 1955 it had grown to 1520 pounds; and this year it will reach the all-time high of 1560 pounds.

What is happening in steel is happening in other metal sectors, all of which indicates that the wire industry can look forward to a growing demand for its many products. If business falls off in 1958, the slowdown will be moderate. What we are suffering from now is not expansion, but a too-rapid rate of expansion.

Edmund Duval Sickels
EDITOR

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Vol. 32 NOVEMBER, 1957 No. 11

Oxide Coatings on Aluminum Wire

by A. A. Defoe, P., Eng.
Chief Engineer, Electrical Conductor Engineering Department
Aluminium Laboratories Limited
Kingston, Ontario, Canada

Introduction

One of the chief characteristics of aluminum is its affinity for oxygen. When exposed to the atmosphere, aluminum quickly acquires a protective oxide coating which plays a decisive role in the performance of the metal. This natural oxide film is very thin but continuous and adherent and limits further oxidation thereby protecting the underlying metal. The unusual resistance of aluminum to continued oxidation was recognized many years ago, but it was not recognized that this resistance was due to the ever-present natural oxide film. Considerable information is now available on the characteristics of this oxide film and processes have been developed for producing a thicker film, but extensive research is still required on production conditions as well as to elucidate further the behaviour of oxide films in oxidizing and corrosive environments. This paper will discuss some of the fundamental principles underlying the formation and properties of the oxide coatings on aluminum wire.

A. A. Defoe

This paper was presented at the Annual Convention of The Wire Association in Chicago, Ill., on October 14, 1957.

The author graduated in 1924 from Queens University with a degree of B.Sc. in Electrical Engineering. He took a test course at General Electric in Schenectady from May, 1924, to August, 1925, and joined Canadian and General Finance Co., Toronto, as an electrical engineer. In the same capacity he had charge of electrical construction with the Sao Paulo Tramway Light & Power Company in Brazil in 1928 into 1930. He became an electrical engineer for the Aluminum Company of Canada and Aluminum Laboratories in 1930, working on electrical conductors and transmission line engineering into 1944, when he was appointed to his present post. He is a member of The Wire Association and other societies.

Formation of Natural Oxide Film

When oxide-free aluminum is exposed to the atmosphere, a film starts to form immediately. The initial rate of oxidation is rapid and a protective thickness of from 15 to 20 Å may be reached in from 10 to 40 minutes. Subsequent growth is slow and although the thickness will vary a maximum of approximately 100 Å (approximately 0.0004 mils) will be reached in about one month.

★ ★ ★

The nature and thickness of the film formed depends on the environment to which the metal is exposed; the thicker, more protective films, except under extreme conditions, being formed in the more corrosive environments. The most reliable observations indicate that at ordinary temperatures a film thickness of less than 50 Å is formed in dry oxygen, whereas if water vapour is present the speed and amount of oxidation increases with the result that the film thickness may be double this amount at 100% humidity. The thickness of the film in air will be slightly greater than in dry oxygen because air contains some water vapour. This applies as well in coastal and industrial corrosive atmospheres because in both these environments the films tend to build up to suitable protective thicknesses. They are also thicker on rough than on smooth surfaces.

Although it may not be of significance insofar as commercial purity electrical conductor wire is concerned, the rate and amount of oxidation also increase at the higher temperatures. At temperatures of just below 300°C a limiting film thickness of a few hundred Angstroms is approached, whereas at temperatures above 300°C the oxidation increases rapidly and a thickness in the order of 1000 Å may be reached.

★ ★ ★

The formation of the natural oxide film on aluminum is very complex. It is sometimes assumed that the oxide films grow by movement of the oxygen inwards to meet the metal, but recent research has shown that most types of films grow by movement of the metal outwards to meet the oxygen. When oxide-free aluminum is exposed to the atmosphere at room temperature, the first thing that takes place is the adsorption of oxygen molecules as atomic oxygen on its surface, where they react chemically to form aluminum oxide. More oxygen is then adsorbed on the surface of this monomolecular layer of oxide and this oxygen is converted into negative ions by electrons which can pass through the film because of their small size. This ionization of the adsorbed oxygen sets up an electrical field in the oxide film which causes the aluminum ions left behind in the metal to migrate towards the surface of the film where they react to form oxide. The aluminum ions are comparatively large and they need the assistance of the electric field to help them pass through the film. As the process repeats itself, the film gradually grows in thickness with the result that the electric field intensity within it diminishes and finally is no longer strong enough to assist the aluminum ions through the film. When this stage is reached the film growth must necessarily cease and no further reaction takes place.

Composition of Film

There is general agreement that, insofar as can be determined by X-ray and electron diffraction techniques, the natural oxide films formed on aluminum in air are usually amorphous alumina and are referred to as aluminum oxide. There are, however, certain crystalline forms in which aluminum oxide occurs and, in addition, the oxide is known in several hydrated forms. The alumina hydrates are formed when aluminum is subjected to very highly humid atmospheres or immersed in water. The alpha-monohydrate, for example, is formed when aluminum stands in water at temperatures from 70 to 100°C, while the beta-trihydrate is formed when the water temperature is below 70°C. Alpha-alumina is formed in air only at temperatures above 1000°C. Gamma-alumina is an intermediate form of oxide and is produced by heating amorphous alumina or one of the hydrates at a temperature of from 500 to 900°C.

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While the scope of this paper does not include a discussion of the films formed on aluminum alloys, it is interesting to note here that those formed on the commonly used Al-Mg-Si alloy wires are not appreciably different from those formed on wire made from electrical conductor purity metal. However, the films formed on aluminum containing appreciable amounts of alloying elements such as copper, iron, etc. are somewhat different as they will contain oxides of the alloying elements.

Properties of Film

The natural oxide film formed on aluminum wire in the atmosphere is so thin and transparent that it is invisible. However, evidence of its existence is apparent when one tries to solder aluminum wires by the usual simple methods. The film is very adherent because during formation it is actually intergrown in the base metal. Also in general, it may be considered as fairly uniform in thickness with good continuity, hardness and compactness. Measurements made to date indicate an average density of approximately 3.4 gr/cm^3 which is slightly greater than that of the aluminum itself. The film should have good abrasion resistance because of the inherent hardness of aluminum oxide but is readily impressed due to its thinness. However, if a wire is scratched or otherwise damaged a replacement protective film is quickly formed.

★ ★ ★

The heat emissivity of polished aluminum is about one-tenth that of a black body. However, the natural oxide film that is formed increases this value and for new aluminum overhead conductors the relative emissivity will be approximately 25%. The films also have a very high resistance to heat owing to the high melting point of aluminum oxide (approximately 2000°C). Therefore, the only limitation on heating which they will stand is that imposed by the melting point of aluminum, which is approximately 659°C.

★ ★ ★

The electrical properties of the oxide film on aluminum wire and especially the electrical resistivity are very important. The oxide of aluminum has a very high resistivity and is in the order of 10^{14} ohm-cm at room temperature. The film is therefore insulating and must be removed and prevented from re-forming when it is desired to have low electrical contact resistances between aluminum surfaces. This is generally done by abrasion through a suitable jointing compound.

★ ★ ★

The dielectric constant of the film varies from 4.5 to 12.5, but a reasonable average value seems to be approximately 7.5 and therefore equivalent to that of a good quality wet process porcelain. However, even a good uniform film will have a very low breakdown voltage due to its thinness and therefore cannot be relied upon for electrical purposes. When a high breakdown voltage is required, the film thickness should be increased by one of the electrolytic processes.

★ ★ ★

The protective action of the film depends to a large extent upon its continuity and its rate of dissolution in the media to which it is exposed. The principal reason why it offers effective protection is that it is relatively insoluble in the corrosive media generally encount-

ered. With oxidizing reagents or under oxidizing conditions, the film tends to remain intact and the reaction rate is low. However, although both aluminum and its oxide are relatively resistant to attack by weak acid and alkaline solutions, they are attacked more readily by strong acid solutions and particularly by strong alkaline solutions.

★ ★ ★

The natural air-formed film on the surface of aluminum may possess initial weaknesses owing to the structure of the underlying metal. These provide the initial sites of attack and corrosion occurs not only through the film being dissolved by substances in solution, but also through its being penetrated and undermined by dissociated ions. Chloride ions are considered as being particularly effective in bringing about the corrosion of aluminum due to their small size and great penetrating power. This would seem to indicate a fairly high corrosion rate for aluminum in the presence of sodium chloride solution, but insofar as aluminum stranded conductors are concerned, this has not been the practical experience because many instances are known where such conductors have been in service for over 40 years in so-called highly corrosive saline atmospheres and are still in exceptionally good condition. This, of course, is due to the fact that the corrosion process itself thickens and heals the film thereby suppressing further corrosion.

★ ★ ★

In industrial atmospheres the corrosion environment generally consists of weak acid and/or alkaline solutions. In this case an oxide film is built up which would be thicker than that in a normal atmosphere and suitable for providing the necessary protection. However, there may be localized areas on wires in a stranded conductor where the solutions are appreciably acid or alkaline and in these cases the natural film is dissolved with resulting corrosion of the aluminum wires, usually in the form of pitting.

★ ★ ★

The serious consequences of electrolytic action induced by placing aluminum in direct contact with the more noble metals, such as copper, are well known. The natural oxide film on aluminum only briefly retards the action and cannot be considered as beneficial. The thicker, artificially produced films, however, retard the action considerably but even they will break down in time and allow corrosion of the aluminum to occur by galvanic action.

Artificially Produced Films

The natural oxide films on aluminum wire are too thin for electrical insulation purposes. However, thicker coatings can be obtained by anodizing which is the formation of an oxide film on the metal by making it the anode in an acid electrolyte and passing current.

★ ★ ★

While the possibility of anodizing aluminum wire to provide an insulated conductor with special properties for use in electrical equipment has long been known and experimental quantities have been produced, it has not been widely used on a commercial basis. In all problems relating to the anodic oxidation of aluminum wire, volume output is of prime importance otherwise the cost is prohibitive. The process must therefore be continuous, while the electrolyte and current density as well as other operating conditions must be such that a good, continuous, thick oxide coating is obtained in the shortest possible time. The Aluminum Company of Canada, Limited in collaboration with Aluminium Laboratories Limited have worked on this problem for some time with the result that, in their opinion, the best product is obtained with the multiple compartment, liquid contact, alternating current method using a sulphuric acid electrolyte containing chloride additions which permit the use of a high current density with resulting rapid coating formation. In addition to having the desired thickness up to 0.6 mils, the coating produced by the a-c method is more ductile than that produced by the d-c method, thereby increasing the degree to which bending and forming can be done without disrupting its continuity.

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The Alcan process of anodizing aluminum wire is still in the pilot plant stage. However, to date it has been found that provided the wire is free of scales and other surface defects and is properly cleaned and degreased prior to anodizing, a good, uniform, thick coating can be applied. Alcan has produced electrical conductor grade anodized round wires ranging from 0.025 to 0.128 inch diameter, and rectangular wire up to 0.1 x 0.3 inch at speeds of from 10 to 30 feet per minute with coating characteristics as follows:

Thickness—0.5 mils (127,000 Å)
Breakdown Voltage—150 to 300 volts
Apparent Density—2.5 gm/cm^3
Insulation Resistance—Good
Continuity—Good
Ductility—Good
Abrasion Resistance—Very good

★ ★ ★

It will be observed from the above that if the maximum thickness of a natural oxide film is taken as 100 Å the anodized coating is 1270 times this thickness. The efficiency of such a coating insofar as corrosion protection is concerned, is therefore many times that of an air-formed film. It will also be noticed that the breakdown voltage at room temperature is fairly high and, although values down to 150 volts were obtained the average is around 190 volts. In this connection it is of interest to note that preliminary tests have shown no change in the breakdown voltages at temperatures up to 600°C. However, all anodic films owing to their porosity have high moisture absorption characteristics and the breakdown voltages just given are for atmospheres of low humidity. It is, therefore, either necessary to p r o v i d e operating conditions where low humidity is maintained, or to seal the anodic film in order to prevent moisture absorption. The problem of sealing is now the subject of active investigation.

★ ★ ★

The usual anodized film is markedly different from lacquers or

(*Please turn to page* 1401)

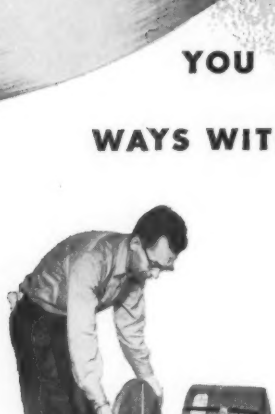
1,000 lbs. OF WIRE

OR 500 lbs.

ACCURATELY PACKAGED AND SHIPPED

WITHOUT A REEL!

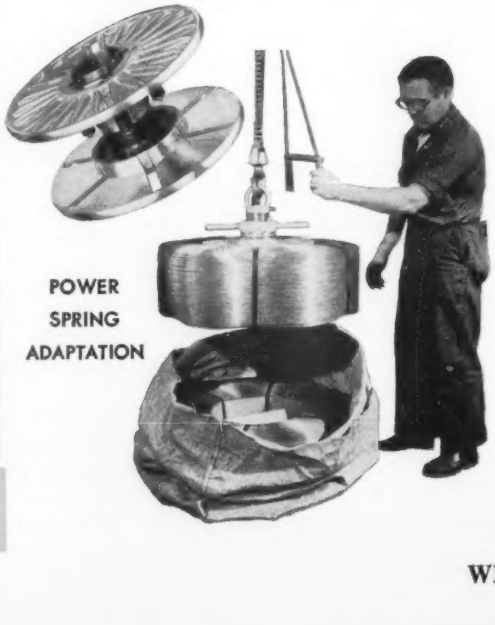
YOU CAN DO IT 2 DIFFERENT WAYS WITH **ACROMETAL** EQUIPMENT



DETAILS OF AIR PRESSURE ADAPTATION

- We have the experience and the practical advantage of developing these systems in cooperation with three big wire mills. Make use of our know-how.
- This process reduces your investment in heavy reels.
- It makes big savings in freight costs.
- It eliminates rewinding before stranding.
- You can anneal wire in these big packages without using reels!
- They tell us this is the most imaginative advance in wire packaging in 20 years and we can help you as we are helping others. *Write us.*

You can use these systems with any kind of wire —copper, steel, brass, bronze or aluminum.



POWER SPRING ADAPTATION

ACROMETAL PRODUCTS, INC.

616 Fifth Street North • Minneapolis 1, Minnesota

The Coreless Coil— A New Wire Handling System

by E. Jefferson Crum
Riderwood, Maryland

"Wire is ornery." No wire man who has ever tried to straighten out a snarl, or looked for a hidden end, or tried to prevent a backlash will ever disagree with this classic statement made by no less an authority than the late Mr. Ken Lewis in his book, "Steel Wire in America." There I believe he says that it takes a special type of individual with a great deal of patience, and a bit of orneriness himself, to become a good wire mill man. A bar mill man receives his stock in straight lengths and has no fear when he starts his operation that it will be necessary to stop in the midst of drawing because the middle has picked up the back end. Likewise, it's smooth sailing for the strip man. He, too, can walk up and down the mill with an air of great confidence, knowing that the back end of his coil is safely locked into the center where it belongs and will not show up before its turn.

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The thin diameter, the enormous length, and the tremendous forces stored up in hard-drawn wire set it apart from other metal working operations. For many years, these problems of wire and rod handling were accepted as something inherent and unavoidable. In more recent years, various moves have been made to aid in wire handling. Larger weights of coils have cut down on the number of ends possible to get lost. More accurate control over spooling has helped. Packaging and shipping wire on stems and in drums has, in many cases, improved the efficiency of wire handling. However, I believe most will agree that there is still room for improvement, that there is still plenty of down time on machines for tangled wire and lost ends, that not only is it necessary to take this into consideration in figuring rates but it also amounts to an appreciable cost in loss due to scrap. With these things in mind, I set out to develop a better wire handling system.

E. Jefferson Crum

A paper presented at the Annual Convention of The Wire Association in Chicago, Illinois, on October 15, 1957.

Mr. Crum holds a degree of B.S. in Metallurgy from the Missouri School of Mines received in 1929. From 1929 to 1951 he worked for Bethlehem Steel Company and in 1951 became affiliated with the R. H. Miller Company. He is well-known as the inventor and publisher of the Crum Calculator for wire drafting, which he first brought out in 1945.

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I have always felt that Mr. Lewis was a little severe in his indictment of wire and have always suspected that, instead of being ornery, perhaps it is misunderstood, mistreated and uncontrolled. The possibility of turning to our advantage the great power stored within a bundle has always intrigued me. If anyone doubt that power, just let him try to restore to its original shape a coil of wire that has "thrown a figure 8." A better understanding of why wire fights back should be the first step in taming it. Next, an examination of wire handling processes will almost always show mistreatment. Many years ago, Mac McIlvried gave me an axiom in wire handling that I have observed to be very true. He said, "An undisturbed bundle of wire seldom gives trouble in paying off." Finally, it has never seemed right to allow a coil of wire to form on a wire drawing block or a take-up block of any description uncontrolled. To allow individual convolutions of wire to follow the path of least resistance, to be thrown hither and yon by centrifugal force and, particularly, to be allowed to rise and fall and shuffle about on a horizontal block just doesn't seem the right approach in producing a coil of wire which we later hope to pay off continuously and free of tangles.

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Besides being tangle-free, any newly-developed, up-to-date packaging system for wire must satisfy the present-day customer demand for the largest possible unit weight consistent with his handling methods. It should, of course, also have the lowest possible tare weight.

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Meeting all these specifications with one type of package is a large order. Spooled wire, I believe, is generally more free of pay-off problems than spirally wound bundles. However, weight and tension and the necessity for shutting down a rotating spool before starting another are all problems that favor the spirally wound coil. For these reasons, it seemed best to adopt this spiral method of building a coil and to try to improve its pay-off characteristics. To better understand this problem, let us look at some of the reasons for down time due to snarls when this

type of coil, normally formed, is used. We all know that wire with a reverse cast or an irregular cast is difficult to handle and causes tangles, especially in flipping from a stationary stand as opposed to reeling from a rotating swift. Kinked wire from handling can, of course, give trouble. These causes are accidental. The major cause of tangles and snarls, however, is not from accident but is inherent in the method used in forming, handling, and paying off the coil. I am speaking of the displacement of strands or individual coils during these operations—our almost complete disregard of what happens to those individual strands which were so beautifully formed on the first few inches of the winding block. From that point on, we leave the individual strands in the hands of centrifugal force, gravity and fate. This is especially true of a block with a horizontal shaft, the design of which makes it almost impossible to hold the individual coils in their original positions. To illustrate this point, let us look at some pictures of wire coils selected at random from our official publication, "Wire and Wire Products." Fortunately, most of these displaced coils somehow find their way back into position during paying off but we have no assurance that any one of them will not stay snagged under some of the succeeding coils and cause trouble.

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One answer to this problem is rather simple and is the basis of the development which I am calling the "Coreless Packaging System." In building this package, the individual convolutions of wire are laid down and locked into a pre-determined geometrical design. One of the simplest of these designs consists of layers of carefully made and separated loops — see figures 1 and 2. Here the layers are placed longitudinally on a rectangular pallet. Another preferred geometrical pattern is shown in Figures 3 and 4. In either case, the package consists of layers of wire having a uniform, progressive geometrical design. You will note that the loops are placed free from each other and free to pay off in the reverse succession to which they were laid down.

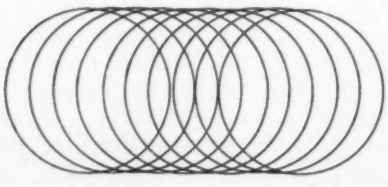

Fig. 1.

Fig. 2.

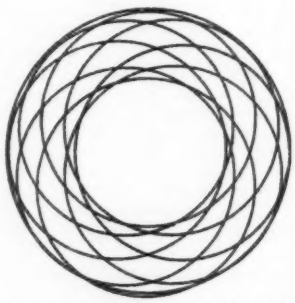

Fig. 3.

In the first case, the wire is laid down according to the design on a pallet or some other holder such as the bottom of a corrugated box. Upon reaching the end of the pallet, the wire is laid down in the opposite direction to form the second layer. It is possible to stack many layers of wire, one on the other, in this fashion and obtain a self-supporting, very sturdy bundle. The herringbone effect produced by these layers of wire progressing alternately in opposite directions is unusual and pleasing in appearance.

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The second package, in which the wire is laid up in circular layers in one great spiral, also has a pleasing appearance. The strands

Fig. 4.

can be seen to be free, one from the other, and the layers are of uniform length and thickness. When viewed from the side, the circular package resembles a coil of wire rope.

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To form these new packages, we have designed a machine with an upsidedown dead block. (Figure 5). The wire falls from this block in a continuous spiral at a constant level onto a collecting pallet. In the case of the rectangularly shaped package, the pallet, which is approximately 2½ times as long as it is wide, is reciprocated to collect these scrolls of wire in layers. This delivery level is maintained automatically by a feeler arm actuating a micro-switch, which, in turn, opens a hydraulic valve on the vertical piston supporting the forked lift arms on the undercarriage. Finally, when the space below the block has been filled, or when the desired weight of wire has been attained, the pallet is lowered the last short distance onto a dolly.

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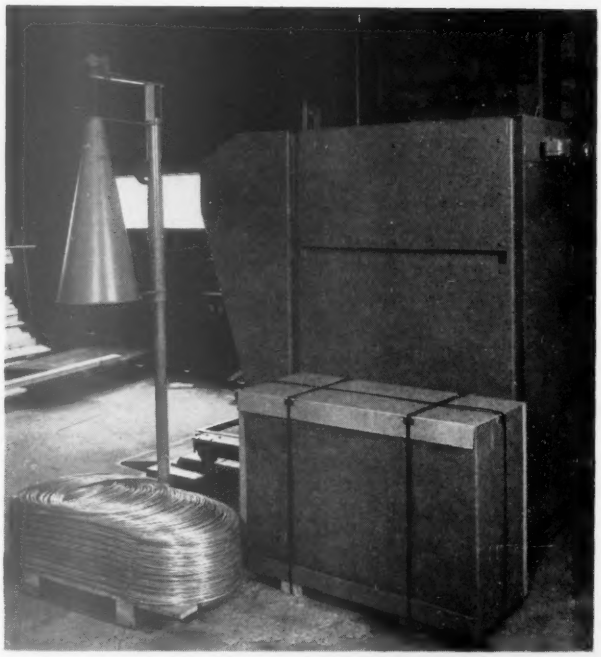
In the meantime, the wire take-up is not stopped but, rather, the wire is allowed to fall into the wire holder which continues to reciprocate at the normal rate. When a new skid is put on the empty arms and raised to the proper elevation, the collected wire is

Fig. 5—(above) * * * * * * * * * * * * * Fig. 6—(right) * *



dropped on to the pallet as the wire holder is opened.

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When forming the circular or doughnut-shaped package, a turntable is used to collect the wire. It is supported on the arms of the fork lift and rotates very slowly and at a regulated speed eccentrically to the block above it. Figure 3 illustrates the relationship between the nominal diameter of the spiral, the outside diameter of the package, and the inside diameter of the package. The density of the package or the footage in each layer is controlled very accurately by varying the speed of the turntable to give a calculated relationship to the number of turns per minute of the spiral dropping from the block above. (Figure 7). Constant level control and the removal of the finished package is much the same as in the case of the rectangular pallet.

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Obviously, the various motions in this machine could be produced by various means. Since we were striving to produce the most modern wire winding machine, we decided to adopt hydraulic power throughout. Thus far, we have been very pleased with the results, some of which we do not ordinarily find in wire take-up equipment. For instance, the main drive has infinite speed variations from 0 to top speed. The control dial for this speed variation can be calibrated in feet per minute. Likewise, the

Fig. 7 * * * * * * * * * * * * * * *

shuttle speed or the rotation speed of the collecting table is infinitely variable and calibrated so that definite lengths of wire can be laid down in each layer. To gain a more dense bundle, the vertical piston can be made to move the mass of wire upward against the wire former to compress the package. One of the most interesting features of the machine is variable torque control. In starting to wind or take up a given wire in a process, the torque is increased by turning the torque control handle until it is great enough to move the wire. The gauge is then set at a somewhat higher figure to allow for some variation in the backpull of the wire; however, if a wire hangs up and this backpull is too great, the winding arm stops. This feature not only can save broken wires but, in many cases, broken bones on the operator.

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The original circular package, providing the inside diameter is large enough, can be paid off on a regular rotating reel or flipping device. However, when the rectangular package was developed and it was not possible to allow the wire in paying off to pull up around the core, it was necessary to develop a new means of paying off. At first, this seemed to be an almost insurmountable problem and, as far as I can determine, one which no one ever really had to face. Wire bundles have always had an opening in the center and have always been placed over a core for paying off. All known conventional types of flippers, including flyers, whirligigs, tensioning devices, etc., were tried unsuccessfully. In all cases, the wire twisted and turned and relieved its fury until it turned into something that resembled the new earth satellite.

The study of the flipping process that resulted in our new method of coreless flipping is much too long to be included in this paper. A number of very interesting mathematical and physical observations made in this study will, I hope, be covered in a later paper. For the time being, I can report that the wire is under good control in paying out of either of the packages. Once again, it was a case of understanding the wire, not interfering with its natural flow, and using the forces within the wire to our advantage rather than letting them go uncontrolled. After our simple mechanism for paying out was developed, we now insist that nothing be allowed to touch the coil internally during pay off. Even the circular doughnut-shaped coil, with an opening in the center, for best results must remain coreless.

Advantages of Using the Coreless Coil

Let us now review the specifications for a good package of wire and see how users of the Coreless Coil can expect to benefit:

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1. Our ideal coil should pay off free of tangles. It is theoretically possible, in the case of the circular Coreless Coil, to build up a package of wire with each loop placed free and clear of every other loop. In actual practice, the loops of wire are placed much closer together but still there is no trouble with individual loops freeing themselves. In this package, wire is laid down in a definite pattern and comes out of the package in reverse order. There is no possibility to lose the ends of this bundle, nor is it possible for the bottom end to be mistaken for the top end. Should it happen that sections of the coil be damaged in transit, or should any other accident to the bundle cause a tangle, it is not a serious affair. At worst, a loop can become entangled with a few of its neighboring loops. There is no way for a loop to become entangled with loops located a great distance away. Wire wound in this fashion will give very close to 100% tangle-free pay off. I don't feel it is necessary to point out just what this means to production costs when machine down time and scrap losses are cut.

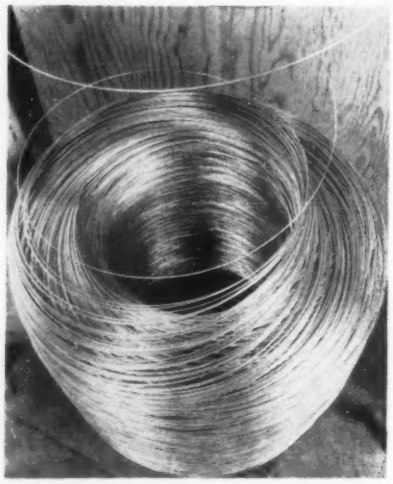

Fig. 8

2. The package should be capable of containing a great weight of wire. Mechanical handling methods have improved in recent years, and the gradual trend toward larger weights of wire in a package has been accelerated. Good density can be obtained by this packaging method; for instance, the 16½ x 40 pallet covered by the 30" high box shown in Figure 6 contains 1,000 lbs. of 16-gauge galvanized wire. This is a density of approximately 85 lbs. per cubic foot. Other measurements have shown a higher density. Surprising as it may seem at first, the circular package has given us densities as high as 120 lbs. per cubic foot. Our only limitation on weight per package is the dimensions of the machine which, of course, can be changed through design.

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3. The coil shall pay out freely at high speed. The trend has been, and undoubtedly will continue to be, toward higher speed wire machinery. The wire package should not interfere with this progress toward higher speeds. The Coreless package meets this specification very well. The ultimate speed of pay-off has not been determined; however, in one experiment, .032 annealed stainless wire was paid out of an 8" nominal diameter Coreless package at a speed in excess of 1,500 feet per minute. We feel much greater speeds are attainable. See Figure 8.

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4. **Continuous operation.** More and more wire processes are demanding a continuous operation; that is, the ability to weld the back end of the current bundle to the front end of the next without stopping the flow of the wire. By flipping from the Coreless package, this is, of course, a relatively easy thing to do. Ends are very free to be found.

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5. The package should not limit the choice of shipping methods. Here the Coreless package seems to be unique in that it can be designed to suit most any shape or size container, or can be shipped with straps like an ordinary bundle. Tare weight is usually low. The package can be formed to rather close dimensional tolerances. A number of unique ideas have been proposed for transporting this coil. While I am not free to disclose these, they will undoubtedly show up soon.

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6. **Even lengths of wire or even weight of wire.** Where the specification calls for even length of bundles or even weight bundles, this can be accomplished very readily and without extra expense with the Coreless package. It is merely a question of traversing the pallet or rotating the turntable at a calculated relationship to the laying block above it. In the coil pictured in figure 4, each layer contains 450 feet of wire. If it is desired to use 1,800 feet of wire, we simply lift off 4 layers of wire from the coil.

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7. The coil should be easy to inspect. The side elevation view of a Coreless package is just about a perfect sample of the wire within the package. It can be examined visually and gauged with a micrometer at any point. It is even possible to cut out a sample from any point and mark that point so that the operator will know when he is approaching it that it must be welded.

(*Please turn to page* 1400)

Production Control — Organization and Functions

by J. D. Donovan
Assistant Production Superintendent
Newark Works
Kaiser Aluminum & Chemical Corporation
Newark, Ohio

Some years ago, a Chinese business man was touring industrial plants in the United States. He was invited to talk informally to an association meeting such as ours about the things which impressed him the most. His replies brought us up short. He thought the key to our manufacturing success was the freeness with which we exchange information in our business publications and our trade journals. And what did he think was our finest industrial application? You guessed it! Our water systems! Of course, he was looking at us from his own problems, but he did remind us quite dramatically that there are things we take for granted.

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Today, we have the opportunity to exchange ideas on something as basic as a water system. We're going to talk "Service". We'll talk about service from the point of view of Production Control problems in machine loading and scheduling. We'll talk strictly about what we do and why at Kaiser Aluminum's Newark Works.

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Today's customers, specifically 1957, are influenced by only three factors—quality, price and service. Down deep in our hearts, we silently admit that ABC Company produces a comparable product to XYZ, but ABC is in trouble—they don't deliver when the customer wants it. The byword today is and must be Service.

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Service cannot be attained without a well organized Production Control Department. This is the heart of your production peaks, valleys and bottlenecks. It is the core of a successful sales program.

J. D. Donovan

A paper presented before the Non-Ferrous Division of The Wire Association at the Annual Convention in Chicago on October 14, 1957.

Mr. Donovan graduated from Rutgers University in 1948 with a degree of B.S. in Business Administration. He joined Kaiser in 1950 and has been successively Assistant Production Control Superintendent, Production Control Superintendent and Assistant Production Superintendent.

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Originally, we were going to write a detailed paper on Kaiser Aluminum's Production Control approach through new systems, tabulating and electronic equipment, that are readily available today. Because of high overhead, lack of experienced personnel, and need for detailed management control information, we are experiencing a revolution in the office equipment field. The experience and training programs of these vendors as applied to Production Control are far behind their advanced equipment. We have developed our program simply, insisting on gradual but positive steps to replace our manual systems.

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Production Control can be defined as the planning and scheduling of manpower, machines, and materials for optimum service to the customer and maximum profit to the corporation. Obviously, 1957 accents the maximum service to the customer. The Korean and World War II periods dictated maximum production. Before getting into our organization and paperwork flow, I want to discuss four important points.

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Let's take a look at our organization, as shown on Chart Number One. Our Production Control Superintendent reports to our Production Superintendent, who in turn reports to our Plant Manager. We bring our Operating and Production Control personnel into the closest possible contact. Functionally, our Production Control section is guided by our Sales Product Office. The Product Office and Production Control work together directly. The Plant Manager and the Production Superintendent are only brought into decisions by exception. The authority, responsibility, and scope of Production Control must be clearly defined and accepted by operating and management personnel.

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If it be the decision of top management to have an effective Production Control, they must have full confidence in the personnel selected and must accept their

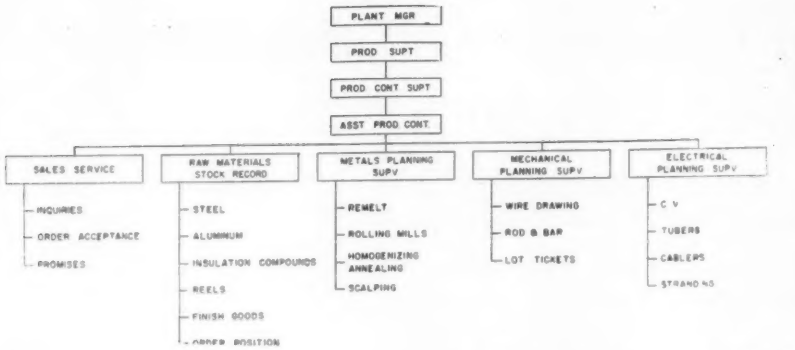

Chart I

decisions. There is no half-way point. Full value will not be received unless this group is given the authority to carry out its responsibilities. Complex industry today dictates that some one department with the over-all plant look recommend the decisions. Gone are the days of family corporation where Pop knew all the answers and made all the decisions. There is nothing more discouraging to the Production Control Department or its personnel, than to be consistently overruled by top management — this is wasted money.

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At Kaiser, we stress two factors in Production Control—planning and scheduling. Planning is the long range approach (depending on the order position and the product involved). Scheduling is the daily execution of your plan.

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We must, at this point, emphasize that practically every plant we have observed has good scheduling habits, but these are quickly diluted by the complete lack of planning to give integration and common sense to scheduling. Our operation has a favorite slogan I would state — "The biggest problem in Production Control is to find the problem"—the solution is relatively simple.

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Please do not consider the above a small or minute point. How many times have you run into the following situation:

Supervisor—Q. Why did we miss this promise?
Planner— A. It was cabled too late.
Q. Why?
A. The compound wasn't ready.
Q. Why?
A. The anti-oxidant arrived late.
Q. Why?
A. It was ordered late.
Q. Why?
A. I thought we had enough compound to support this week's schedule.

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We have been embarrassed many times for erroneous reasons presented for missed promises or production bottlenecks. The lack of planning is shown both by the fact that the problem was caused by poor planning and by the fact that the schedulers didn't know the real cause of the problem.

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Personnel—We will not try to say that Production Control people are a different breed of cattle, but all types will not satisfy the position.

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Personality is probably the foremost attribute. The ability to get along with department heads and yet be firm enough to insist on complete conformance to schedules is a must. A likeable personality —one who gets along with everyone—is not necessarily desirable.

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Inquisitiveness — A planner must have the sixth sense to anticipate problems.

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Analytical Ability—Judgment—He must look at all the problems clearly and then call the shots.

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Education—He must be at ease with figures, production rates, percentages, and in fact, have a slide rule sticking out of his pocket. He must have the ability of both clear oral and written presentation.

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When we look at our personnel, we find that approximately half are supplied from our hourly ranks —former machine operators, etc. The remainder have college backgrounds.

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Expediters—We reorganized our organization and established the positions of planners and schedulers. Thus, we now have men who actually schedule the material through each operation. Each man does his own expediting since he knows specifically at any time the exact location of material in the fabrication process. Many organizations have men who do nothing but say to the foreman—Where is this?—This is hot!—Run this next! He contributes nothing to orderly planning and scheduling. We say, make the men responsible for planning—responsible for expediting.

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As shown in the preceding organizational chart, our Production Control Department reports directly to the Plant Superintendent (Production Superintendent). Our specific organization structure can be divided into two groups—Line (planning and scheduling) and Staff (order entry, sales service and raw materials).

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Referring to our chart, it can be noted that there is a supervisor responsible only for sales service. Our present volume of business demands three order correspondents. This function of Production Control is quite frequently touched on lightly by our textbooks, but at Kaiser, it is on equal footing with our actual planning sections. The group is responsible for the acceptance of orders including correct price, availability, packaging, description, delivery requirements, and finally, the actual promise.

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We endeavor to have this sec-

tion develop an awareness of customers' requirements. This, of course, is developed only by close coordination with our sales staff, including the actual salesmen. When production bottlenecks occur, this group many times can name the priority because of the familiarity with sales problems.

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Each week through the use of IBM listings, every open order is promised or repromised as the case may be, and this information is sent by teletype to our sales districts and branches. A well-informed sales force pays dividends.

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Inquiries and expediting of existing orders are funneled through this group. As a matter of policy, all correspondence is channeled through our sales organization—no direct customer contacts. If a customer does call the mill, we accept the inquiry or point in question, and then immediately contact the sales district that services the customer to relay the information. We find that this approach has two advantages;

(1) It eliminates any possible conflicting information from sales and the mill,

(2) It gives our sales force another reason to contact the customer. During the past five years, the program has proven very successful—the criterion of performance of this problem is a well-informed sales force.

★ ★ ★

As a further service to our customer through our sales force, every week we publish a "Delivery for New Business Report." This report shows our mechanical and electrical products broken down by size range, alloy or construction in the left hand column, and promise dates at the right. This report serves to advise Sales the present lead time required on routine business. If rush delivery is required, the mill should be contacted. Also, attached to this report is a list of our finished goods, stocks and surplus material. We have found that this advice has greatly diminished the need for sales to contact the mill.

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A second section of our Production Control is called the Order Entry and Raw Material Section. An IBM card is punched for each item on each order received at the mill. Included on the single card is customer name (10 columns), sales district and number (6 columns), item number (2 columns), E. C. product category and code (7 columns), gross weight (6 columns), planning code (3 columns), order quantity (6 columns), promise date and change date (7 columns), order status—open, partial, complete (1 column), missed promise code (2 columns), order acceptance date (3 columns), and last active date (4 columns).

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From the above single card, we know daily the exact load on the plant by week, month, and year by product. At present, we have devised a system of actual machine loading through IBM in which we know how many shifts we have for a given machine or machine group by week or month. From this same card, we receive alloy requirements used to order aluminum pig from our Chalmette and Mead reduction plants. We can find how much steel and what sizes for ACSR constructions are required at any given time. We can also learn the reel requirements by size by using the planning codes. Finally, we can list those items to be shipped from stocks versus those to be produced on a special production run. Each company has specific needs, and as shown above, ample information can be obtained from but a single order entry card. Of course, the use of a deck of cards would minimize the amount of coding required. We have found, however, that constant use of codes breeds familiarity. Our planners can read a series of three digits and state positively that the material is T-4, 12 foot lengths and standard package, or B steel messenger, standard coil with certified data.

★ ★ ★

As briefly stated above, the order entry function has completely been converted to punch card processes.

★ ★ ★

This section is responsible for maintaining minimum and maximum inventory on all authorized stocks of finished goods, and actually orders the material from the planning department. In a similar manner, steel, pig by aluminum content, and ingredients for insulating and jacketing compounds are maintained and requisitioned through our Purchasing Department by means of travelling requisition.

★ ★ ★

Our actual planning and scheduling are divided into three distinct sections—Electrical Products,

(*Please turn to page* 1397)

NEWARK FABRICATION PLANT FLOW CHART

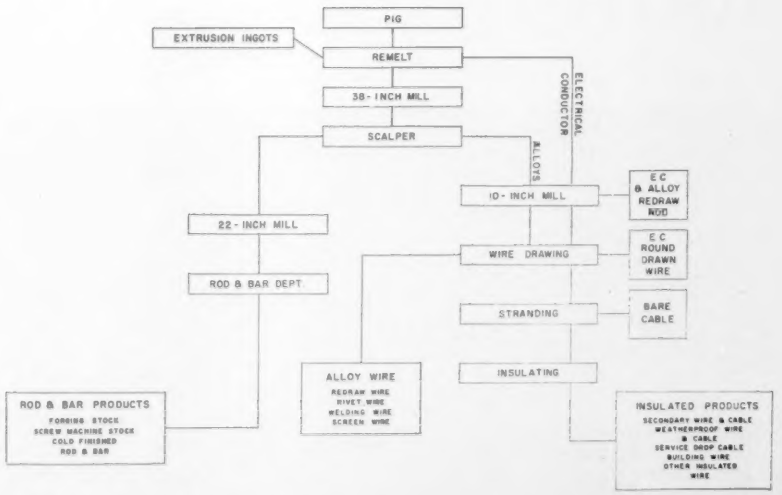
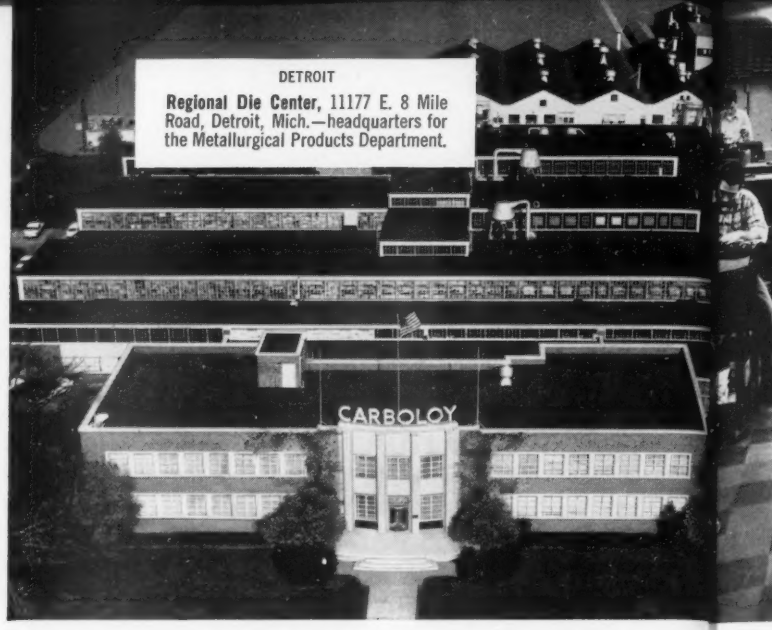


Chart II

- Chicago
- Detroit
- Los Angeles
- Newark
- Philadelphia
- Pittsburgh



DETROIT

Regional Die Center, 11177 E. 8 Mile Road, Detroit, Mich.—headquarters for the Metallurgical Products Department.

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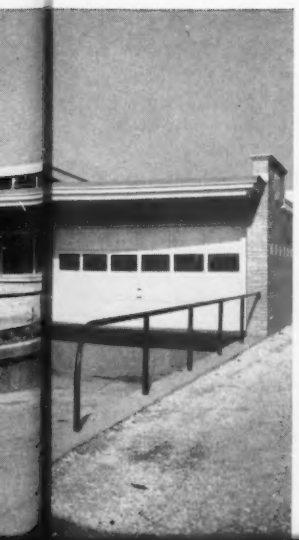


LOS ANGELES

Regional Die Center, 2106 W. Washington Blvd., Los Angeles, California.

Plated Wire from the Consumers' Standpoint

by L. L. Johnson
Engineering Specialist—Finishes
Appliance Engineering Department
Philco Corporation
Philadelphia, Pennsylvania

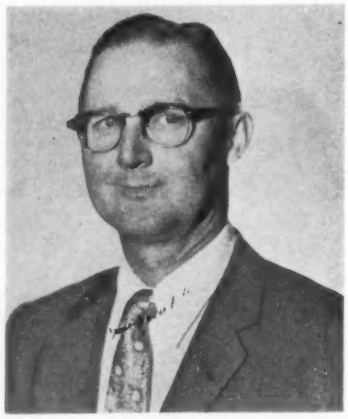
I wish to thank you for the opportunity, which has been given me by your organization, to speak to you on this occasion as a representative of the Appliance Industry. During the time which has been afforded me, I would like to bring to your attention some of the major applications of plated wire in the appliance field, the requirements of plating in various applications and some of the test procedures used to insure quality and uniformity of plated wire parts.

★ ★ ★

In viewing the subject "Plated Wire From The Consumers' Standpoint," it is desirable that we think in terms of the end user of the various products involved. Each one of us have at various times been confronted with the problem of buying a major appliance item for use in our own home. It is human nature to give utmost consideration to obtaining the greatest value for our dollar. Likewise Mr. & Mrs. Average Buyer will carefully select that product which, in their opinion, provides the better balance of value, based on Appearance, Durability, Economy and Convenience from a utilitarian standpoint. Plated Steel Wire answers the purpose in each of these categories to a certain degree, however there are conditions which limit its use.

★ ★ ★

The high lustre appearance of chrome plated wire on a product is usually considered enhancing and with proper lighting effects can be appealing on the sales floor to the prospective buyer of a product. Appearance alone, as we all know, is not enough, therefore the prospective customer must be assured that there is sufficient durability



L. L. Johnson

The author delivered this paper as a part of the Symposium on Plating Wire for Eye Appeal at the Annual Convention of The Wire Association in Chicago on October 14, 1957. He has been with the Philco Corp. for 18 years, serving in the Engineering Department of the Appliance Division as Assistant Chief Draftsman, Project Engineer and currently as Engineering Specialist on Finishes.

to withstand the normal usage conditions the product will be subjected to in the home. This quality requirement is equally as important on numerous wire products finished with Electro Zinc.

★ ★ ★

Cost of tools and tooling time is always a very important factor to consider when working out designs for the manufacturing of a product. Consideration of wire in design of suitable components is worthwhile due to the usual economy found in tooling costs and the short time required to produce completed parts.

★ ★ ★

In the Appliance Division of **Philco Corporation,** with which I am associated, plated wire is used primarily in Refrigerators, Freezers and Ranges; while very little or none is used currently in our Air Conditioners and Home Laundry. This principal usage consists of Storage Shelves and Baskets in Refrigerators, Storage Baskets in the Freezers and Oven Racks in Ranges.

★ ★ ★

Currently the only steel wire shelving used in our Refrigerators are finished with Electro Zinc plate followed by a corrosion resistant treatment of the zinc surface plus a coat of clear baking type enamel. These shelves are used only in the low end of our line since tests have proven them not entirely satisfactory in Refrigerators incorporating an Automatic Defrost principle. Refrigerators of the Automatic Defrost type maintain a much higher relative humidity in the Food Storage area than those of the conventional or Non-Automatic type and this is conducive to a more rapid corrosive condition. We have found this humid environment to be extremely severe on Steel Wire Shelves finished with Copper, Nickel, Chrome plus a clear coat of synthetic enamel and, as a result, have found it advisable to resort to Aluminum Shelves to withstand this condition which is usually most severe in the Gulf Coast area. In the last few years the shift to aluminum for this purpose in Automatic Refrigerators has been the general trend with the majority of Appliance Manufacturers.

★ ★ ★

In order to acquaint you with the moisture conditions to which parts may be subjected in a Refrigerator interior and also show you some of the major uses of ferrous wire in our appliance products, the accompanying views have been prepared.

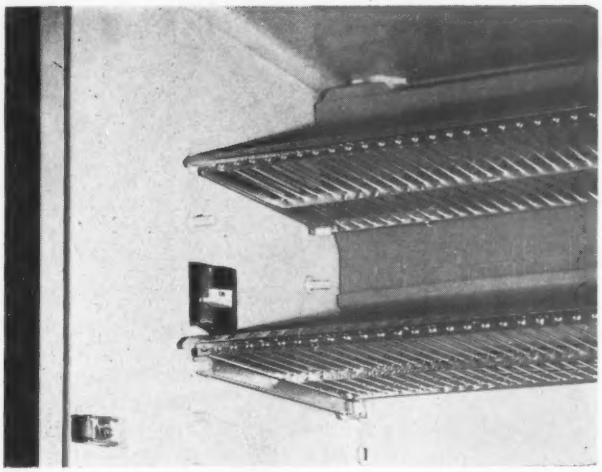


Fig. 1—Shows condensation of moisture on shelving. * * * *

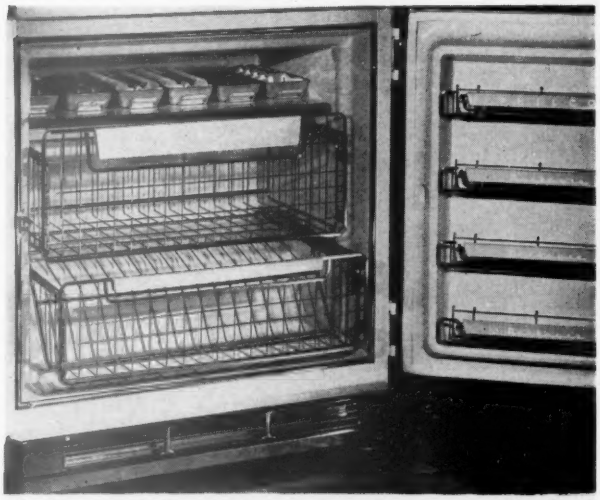


Fig. 2—Storage baskets in freezer compartments. * * * * *

In Figure #1 you will note a close up view of the shelves in a Refrigerator which shows the enemy of ferrous wire. This extreme condensation is representative of conditions normally found in hot and humid localities such as the Southern or Gulf Coast areas. A good plating finish of Copper, Nickel and Chrome plus a coat of clear baking enamel which results in a high lustre, eye appealing shelf, desirable from a sales standpoint, could quite suitably be used if it would withstand this condition in field usage. The usual breakdown resulting in red rust, which is always objectional to the housewife, occurs at the welds and at pit spots on wire and front Decorative Moulding. This is sometimes caused by the rough bottom on milk bottles and other similar containers which are slid over the shelves during normal usage. A more durable finish of suitable appearance to meet these conditions could pave the way toward increased usage of ferrous wire for Refrigerator shelving and similar applications.

★ ★ ★

Currently the finish used on our Storage Baskets in Freezer Compartments shown in Figure #2 is Copper, Nickel, Chrome, plus a coat of clear baking enamel. This type of finish is used primarily to obtain high lustre appearance since the below freezing temperature maintained in these compartments does not present a particular corrosion problem. Electro Zinc finish for such an application could be used, however the attractive lustre appearance of chrome plating would have to be sacrificed.

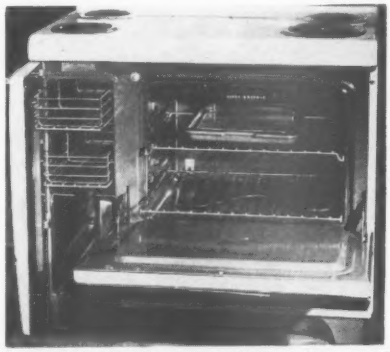


Fig. 3—Interior of range, where adherence of coating material is important. * * * *

In Figure #3 showing the interior of one of our Range Models, I would like to point out several additional items incorporating the use of plated wire. These consist of Oven Racks, Broiler Pan Trivet, Heating Element Frame and Utensil Storage Support finished with Nickel plate and Storage Baskets finished in Bright Zinc Plate. Since Ranges do not present the severe humidity problem found in Automatic Refrigerators, plated wire parts used in them do not ordinarily result in field problems beyond an occasional report on loss of plating due to flaking. This lack of adhesion is most usually due to attempted application of plating over a contaminated wire surface. Close control over plating solutions and handling procedures should be exercised to insure the utmost in uniformity of quality to meet the consumer's specifications.

Testing Production Parts

The Manufacturer of Appliances for the highly competitive market of today must make a special effort to produce a quality product. In order to maintain control of quality of the numerous components that go into the manufacturing of our appliances, definite test procedures are established through specifications. These tests are conducted by the Technicians in Laboratories of our production plants. Those pertaining to plated wire parts are as follows:

Plating Thickness

A representative part is chosen at random from a shipment received. Wire Sections are cut from the part and are in turn molded into a cylinder of suitable plastic material with the cross section or end of wire exposed. Thorough polishing of the cross section must be made with numerous grades of emory polishing paper and polishing compounds. After completion of this operation, the polished end of the wire is etched with a suitable acid treatment to bring out a definite contrast between the different layers of plating and the steel base metal. Observation of these sections is then made by a

(*Please turn to page* 1395)

Aluminum for Fastener Production

by O. L. Burtenshaw
Technical Coordinator
Rod, Bar and Wire Division
Kaiser Aluminum & Chemical Corporation
Newark, Ohio

The versatility of aluminum with regard to light weight, wide range of mechanical properties, corrosion resistance, and natural attractiveness suggests numerous applications in the general field of fasteners. As the field of aluminum structural application broadens so does aluminum fastener application become more extensive. Aluminum fasteners are also finding a variety of applications in plastic, wood and other non-metallic materials where good appearance is important. The aluminum surface does not discolor, and adjacent areas of the assembly are not stained and streaked by off-color metallic corrosion products. Aluminum components should be fastened with aluminum to prevent the danger of galvanic corrosion.

★ ★ ★

Where applicable the cold forming of aluminum fasteners offers two big advantages over machined fasteners. First, there is little or no scrap. The larger part pictured in Figure IV was cold headed with 100% metal recovery. Machining of this same part would have generated 76% scrap. Second, as illustrated in Figure I the part will be stronger than if produced by machining due to the optimum alignment of grains in the direction of cold flow.

★ ★ ★

Aluminum availability includes a complete range of alloys and sizes in finished rivet wires ready for heading and forming machines and also high quality redraw rod from which the customer draws his own rivet wires.

★ ★ ★

The bulk of aluminum wire production starts with redraw rod in coils of approximately 42" I.D. The end use of the various types of fasteners normally dictates the aluminum alloy that is to be used. Alloys of aluminum fall into two general classifications. The "common" class of alloys cannot be strengthened by solution heat treatment. Alloys 1100, 3003, and 5056 are the most popular "common" alloys used in fastener manufacture. Desired mechanical properties are developed in these alloys by cold working (strain hardening). The "hard" or "strong" class of alloys respond to solution heat treatment plus (in some cases) precipitation heat treatment. Alloys 2017, 2117, 2024, 6053, 6061 and 7075 are the most popular "hard" alloys used in fastener manufacture. The nine alloys named above make a wide range of mechanical properties available.

★ ★ ★

The redraw rod is finished by hot rolling and is available in either the "F" (as fabricated) temper or "O" (annealed) temper. Hot finishing of the common alloy rod results in an "F" temper which fabricates practically as easily as "O" temper rod. The "hard" alloy rods are normally annealed prior to initial cold working. Typical descriptions of each group would be "3/8" diameter 1100-F Redraw Rod" and "2017-O Redraw Rod".

★ ★ ★

Aluminum should be stored inside and kept dry. Moisture on the rod surface promotes superficial products of corrosion which are very abrasive to dies during subsequent drawing. As aluminum is softer than most other common metals, handling too deserves special precautions. Aluminum rod should be protected from concrete floors by cardboard or plywood.

O. L. Burtenshaw

A paper presented at the Annual Convention of The Wire Association in Chicago, Illinois, on October 14, 1957.

The author graduated in 1950 from Gonzaga University in Spokane with a degree of B.S. in Chemical Engineering. After spending a year and a half in Kaiser's Sheet Mill in Spokane, he was transferred to Bar, Rod, Wire and Cable Mill in Newark, Ohio, in 1951. He served first as a metallurgist in the Hot Mills, and in the Rod, Bar and Wire Departments, and then as Senior Metallurgist. On October 1st of this year he was named to his present post.

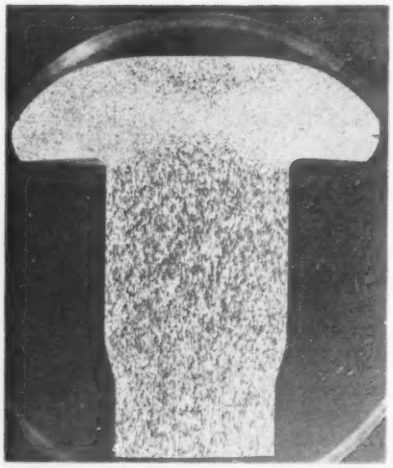


Fig. 1—Section from 2024-T4 lock bolt. Illustrates grain orientation along flow paths. * *

TABLE I

Alloy	Temper	Typical Ultimate Tensile Strength (psi)	Nominal Composition, percent (1)						
			Cu	Si	Mn	Mg	Zn	Cr	
1100	F	15,000	——	—	—	—	—	——	99.0% Min. Al
3003	F	20,000	——	—	1.2	—	—	——	
2017	O	26,000	4.0	—	0.5	0.5	—	——	
2117	O	22,000	2.5	—	—	0.3	—	——	
2024	O	30,000	4.5	—	0.6	1.5	—	——	
5656	F	43,000	——	—	0.1	5.2	—	0.1	
6053	O	17,000	——	0.7	—	1.3	—	0.25	
6061	O	20,000	0.25	0.6	—	1.0	—	0.25	
7075	O	33,000	1.6	—	—	2.5	5.6	0.3	

(1) Aluminum and normal impurities constitute remainder.

The contact areas of forks or booms of power trucks should be covered with wood to prevent scratching and gouging. Time spent to insure proper storage and handling of aluminum pays dividends in greater recovery of finished goods with greater efficiency.

★ ★ ★

Mechanical and chemical properties of redraw are presented in Table I.

★ ★ ★

Wire sizes of aluminum alloys are cold drawn from redraw rod. The mechanical properties of the individual alloys govern cold reduction and annealing cycles which develop optimum metallurgical features in the finished product. Table II gives recommended practices for producing aluminum rivet wires.

★ ★ ★

NOTES:

(1) Minimum reductions before an anneal are necessary to control grain size.

(2) The finish temper is governed by the end use. The cold worked (H) tempers are used when it is possible to do the necessary heading operations with these tempers.

(3) The more highly alloyed heat treatable alloys must be slow cooled to prevent a partial solution heat treatment.

(4) The 3 in temper designation H32 means a stabilizing cycle after final temper reduction. The recommended stabilizing treatment for 5056 is 4 hours at 250° F to 325° F.

Drawing speeds depend upon proper machine set-up, lubrication and pay-off and take-up limitations. Heat build-up and lubrication difficulties are the greatest deterrents to fast drawing speeds. The softer aluminum alloys may be drawn as fast as 5,000 feet per minute. The harder alloys are drawn as slow as 2,000 feet per minute.

★ ★ ★

Pay-off assemblies should be padded with wood at areas where aluminum makes contact. Machine entry guides or rollers should be wood or fiber. Steel guides tend to pick up aluminum particles and subsequently gall the passing rod. Empty die holders should be filled with hollow wooden or fiber guides through which aluminum rod is fed with protection from the frame of the machine.

★ ★ ★

Die nibs of carbide give the most satisfactory performance in coarse aluminum wire drawing. Good blending and proper control of approach angles and bearing lengths are more critical with aluminum drawing dies than with drawing other metals. The aluminum surface tends to wear rings in the approach of drawing dies. Rings should not be allowed to become too severe. Die scratching results from deep rings, and expensive carbide and time are wasted when deep rings must be removed. Entry of the rod and wire into dies should be axial. Non-axial entry of wire into a die

TABLE II

Starting Alloy & Temper	Breakdown Reductions in Area (%) (1)	Finish Temper (2)	Final Reduction in Area (%) (2)	Annealing Temperatures (°F) (3)
1100-F	20 - 90	H14	40	650
		O	25 - 94	650
3003-F	20 - 70	H14	33 - 37	780
2017-O	20 - 65	H13	30	First anneal 780°F and slow cool 50° per hour max. to 600°. Air cool. Intermediate anneal - 660°F air cool. Last anneal - 660°F and slow cool 50° per hour max. to 550°. Air cool.
		O	25 - 65	
2117-O	20 - 85	H15	40	650
		O	30 - 82	
2024-O	20 - 65	H13	30	First anneal 780°F and slow cool 50° per hour max. to 600°, then slow cool to 550°, air cool. Intermediate anneal 660°, air cool. Last anneal - .290" and above - 780° and slow cool 50° per hour max. to 550°, air cool. .289" and smaller - 660° and slow cool to 550°, air cool.
		O	45 - 65	
5056-F	20 - 80	H32 (4)	18 - 21	650
		O	25 - 90	650
6053-O	20 - 85	H13	30	650
		O	20 - 85	650
6061-O	20 - 85	H13	30	650
		O	30 - 85	650
7075-O	20 - 60	H13	30	780° and slow cool 150° per hour max. to 450°, air cool.

is the most common cause of die scratching.

★ ★ ★

The mechanical properties of finished rivet wires vary with the alloys. Typical rivet wire properties are presented in Table III.

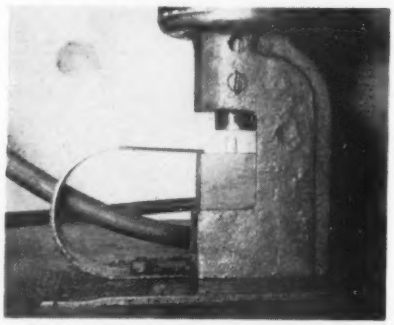
TABLE III

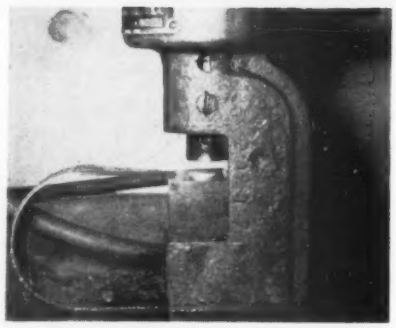
Alloy	Temper	Typical Ultimate Tensile Strength (psi)	Typical Shear Strength (psi)
1100	O	13,000	
	H14	18,000	
3003	O	17,000	
	H14	26,000	
5056	O	42,000	
	H32	48,000	
2017	O	27,000	
	H13	36,000	
	T4		39,000
2117	O	21,000	
	H15	32,000	
	T4		31,000
2024	O	28,000	
	H13	36,000	
	T4		40,000
6053	O	16,000	
	H13	23,000	
6061	O	19,000	
	H13	27,000	
	T6		29,000
7075	O	30,000	
	H13	40,000	
	T6		44,000

★ ★ ★

Aluminum rivet wire should meet rigid surface inspection standards. Drawn-in scratches (slivers) and seams in the finished wire contribute to scrap during heading operations. Visual inspection of each coil, supplemented with upset or twist tests, prevents inferior wire from getting into heading machines and causing trouble in the form of split heads during heading and/or split shanks during driving. Figure II shows rivet wire being visually inspected, and Figure III illustrates an easy method of upsetting. The upset test is used at Kaiser Aluminum's Newark Works to supplement visual inspection. Harmful seams are not readily apparent on the as-drawn wire surface. An upset will quickly reveal these seams in the form of cracks on the periphery of the slug. Small diameter wires are tested by putting several twists in a length of wire. Seams will be revealed by a spiralling, slivered line in the twisted wire area.

Fig. 2—Visual inspection of coiled rivet wire.





Figs. 3A & B—Upset test for seams in rivet wire.

★ ★ ★

Due to its light weight and ductility, aluminum adapts well to heading machines used for other metals. Being more ductile, aluminum requires added handling precautions in comparison with steel or copper alloys. Wooden pay-offs are recommended. The application of a light oil to the wire surface will prevent harmful scratches. Oil may be applied to the coil on the pay-off or by passing the wire through oil-soaked felt pads as the wire feeds from the pay-off. Wherever possible, wooden eyelet guides should be used to protect aluminum from the frame of machines.

Cutoff tools in heading machines should be kept sharp. As aluminum is softer than most other common fastener metals, dull cutoff tools form burrs and rough edges on sheared lengths. These burrs weld to dies and heading tools, causing pits and slivers in the finished rivets. Dies and heading tools should also be kept well polished, as aluminum welds more readily to rough surfaces.

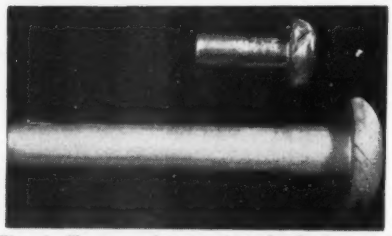


Fig. 4—Shear cracks on rivet head, 2x. * *

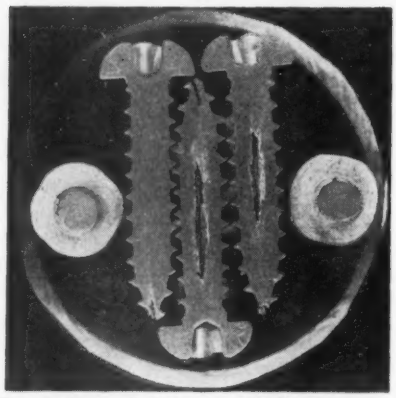


Fig. 5—Ruptured center on 2024-T4 screws, 6x.

The fabrication of aluminum rivets, zippers, bolts, nuts, nails, etc., is too highly specialized for a broader presentation in this article. Problems encountered during the various flattening, heading and other forming operations performed on aluminum wires to produce fasteners must be resolved in the light of a specific operation and desired end results. Cracking can usually be attributed to one or a combination of three variables:

1. **Cold flow excessive for the alloy applied or faulty metal distribution by design and/or staging.**
2. **Stress raisers (seams, slivers, cold "shuts")**
3. **Mechanical properties of the wire too high, especially the tensile yield strength.**

★ ★ ★

Figure IV illustrates shear cracks on the heads of 2024 rivets. The approximate 45° angle is typi-

(*Please turn to page* 1388)

The All-Metal Reel— For Modern Cable Packaging

by George L. McCandless
Vice President
The George Evans Corporation
Chicago, Illinois

By definition the term "Modern" implies something new-fashioned, as distinguished from an older style. When applied to a method for packaging wires or cables, the same meaning—to find acceptance—will depend on some proof of economic advantage.

★ ★ ★

For the costs of adequately packaging and safely delivering wires and cables will affect the producer and user alike.

★ ★ ★

And, since every item of cost presents its own problem, it is natural that manufacturers in a highly competitive industry will give due heed especially to those costs in a category where nothing of value has been added to the product.

★ ★ ★

It follows that due studies have explored new methods for minimizing the costs in this field—and these have led to development of improved packaging devices ranging from the smallest spools to the largest reels.

★ ★ ★

Now, the differing manufacturing facilities required for production of spools or small reels on the one hand, and fabrication of large reels on the other, have established a dividing line of experience to determine the area in which either of these general types of packaging may be usefully discussed.

★ ★ ★

It is, therefore, by confinement to this limitation, as well as through choice by one representing the company most substantially

George L. McCandless

This paper was presented at the Annual Convention of The Wire Association at Chicago, Illinois, on October 16, 1957.

involved in turning them out, that this presentation is offered concerning all metal reels in the larger sizes—more specifically meaning reels of 42″ diameter flanges and larger.

★ ★ ★

Of course this is not a new subject, for the all metal reel in large sizes is not a new thing.

★ ★ ★

Numerous types have appeared from time to time. Most of these were simply developed for hopeful introduction to the trade. But it is noteworthy that those destined for widest acceptance were originated in the industry itself.

★ ★ ★

This came about through consideration of certain physical defects inherent in wood, when used as the material in manufacturing reels required to ship heavy cables. For wood absorbs moisture when exposed to the weather. It attracts termite infestation and is frequently subject to other damage, including dry rot and splintering, to say nothing of fire hazard.

★ ★ ★

Experience showed that the use of reels made from wood had involved the following problems:

Original weights increased as much as 33% due to moisture absorption—resulting in added freight costs for rain water alone.

Cable abrasion danger enhanced by tendency towards weaving action in flanges.

Nails used in lagging frequently resulted in damaged cable.

And reels otherwise damaged often meant damaged cable, resulting in serious losses where an entire project might be delayed because of 2 or 3 damaged lengths of cable.

The necessary cost of recurrent repairs, and short life replacements, must be absorbed in the producer's prices charged to the user for the cable alone.

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Recognition of these risks in the use of wood reels led many years ago to experiments; particularly tending towards steel construction as a logical substitute for wood.

★ ★ ★

Numerous designs were developed and tested by the engineering staffs of important cable producers. Initially this led to the steel angle spoke reel with I-beam or channel section rims. These "Structural" type reels possessed the necessary load bearing strength but failed to meet other objectives on account of their construction costs, greater weights than in wood reels in many sizes, and because the lining head sheets were sometimes subject to detrimental bulging between the angle spokes.

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This produced a lot of further

hard thinking that finally evolved a newer type of steel reel, which accomplished a combination of great strength and the advantage of considerably lighter weights than in wood reels of similar dimensions.

★ ★ ★

The basic feature in the design of this reel lies in the channelled or fluted head sheets and the fact that the entire reel, except for the outer rims, may be fabricated from flat rolled sheet and strip steel.

★ ★ ★

Having open centers in its flanges — incidentally affording ready access to the inside of the drum for cleaning or painting — this reel has become generally known as the Toroidal type reel.

★ ★ ★

Following extensive and highly satisfactory field tests, by the originating cable producer, these Toroidal reels were thereupon adopted by it as preferred in all cases except those involving certain special demands that might require or justify using the heavier and generally more expensive Structural reels.

★ ★ ★

Since these developments occurred more than 20 years ago, the question might arise: "Have these reels attained—through extended use—a sufficiently widespread acceptance over others, so that they are still regarded as the modern reels for cable packaging?" And the answer to this is that today most purchases of all metal reels in the larger sizes are limited to one type or the other (Toroidal or Structural) as previously described.

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The question of selection of one or the other of these reel types will normally be determined by their respective characteristics — but sometimes by other considerations.

★ ★ ★

By its design the Toroidal reel may best be constructed when having a drum diameter that is not less than half the flange diameter. Otherwise the fluted flanges — vertical inside, but tapering on the outside from rim towards center— would produce a disproportionate overall width.

★ ★ ★

Fortunately this preference in construction fully meets the normal requirements of IPCEA dimensional standards as most commonly applied in general usage throughout the cable industry.

★ ★ ★

Hence, in most standard shipping sizes, Toroidal reels are favored over the heavier and more expensive Structural type—except in cases where some special need takes precedence over economy.

★ ★ ★

An exception exists in U. S. Army and Navy specifications, which—at variance with general commercial demands—still call for the older type Structural reels.

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There also may be certain occasions when all metal reels are desired in sizes differing from the drum and flange ratios mentioned as most practicable for Toroidal reels. In these cases the greater dimensional flexibility of the Structural type might recommend it as a suitable alternate.

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However, while the Toroidal reel may be limited to present standard drum and flange diameters, this imposes no restriction on the inside traverse, or barrel width— which, therefore, may sometimes optionally provide a desired cable capacity without recourse to the Structural reel.

★ ★ ★

Now, this discussion started by defining the all metal reel as modern: When qualified as such in terms of economic advantage—and this comes down to a simple question of relative costs for cable packaging by one means or another.

★ ★ ★

The foregoing comparisons of the features and uses of Toroidal and Structural reels—as here outlined in the unprejudiced atmosphere of a current producer of both types—will have tended to indicate that the Structural reel may not fully satisfy all of the above conditions. Yet, it is a modern reel in the sense of present demand from certain important sources or for special purposes.

★ ★ ★

As successor to the older type Structural reel, the all metal Toroidal reel was developed to reduce the costs of cable packaging otherwise generally dependent on reels made of wood—and, from readily available data, it requires only a simple process to compare the relative costs of using wood reels or Toroidal reels as presently constructed from steel.

★ ★ ★

Assessment of the results from a change-over from wood to steel reels may be made in two steps— and the first of these can be accomplished by merely comparing the costs of reels needed in either case for the same service, including the freight expenses incurred while performing this service.

★ ★ ★

Based on experience reports from several cable shippers it is generally expected that wood reels may average about 4 trips. There are cases where Toroidal steel reels are still in serviceable use after 50 trips. So it appears very conservative to assume at least a service life ratio of 5 to 1 for steel versus wood reels—steel 20 trips, wood 4. By weight comparisons the steel reels save 25%.

★ ★ ★

These factors, when applied to procurement costs and average freight delivery distances of 350 miles will show that the total of such costs when using Toroidal reels will be about 40% less than when using wood reels.

★ ★ ★

This is an estimated average result when applied collectively to reel sizes 42″ to 84″ in the respective quantities observed as fairly typical in any operation.

★ ★ ★

These expense ratios apply to service life and shipping costs of steel reels versus wood reels of the

(*Please turn to page* 1392)

NEWS OF INTEREST TO THE WIRE AND CABLE INDUSTRY VOL. II No. 5

WIRE Recorder

T.M. REG. U.S. PAT. OFF. MONSANTO CHEMICAL CO.

PUBLISHED BY MONSANTO CHEMICAL CO., PLASTICS DIVISION, SPRINGFIELD, MASS.

Important Advances in Extrusion Technology

R. D. Sackett — E. H. Hankey

The economic advantages of dry blending polyvinyl chloride resins are well recognized within the extrusion industry. Inasmuch as quality is dependent to a large scale on proper extrusion technique, considerable work has been done in recent years in furthering the technology of dry blend extrusion.

Aside from chemical and physical tests, PVC quality is generally measured by surface appearance, "fish eyes," and porosity. "Fish eyes" and porosity (due to air entrapment) are dependent to a large extent on dry blending conditions. Unfortunately they have an inverse relationship in that as "fish eyes" improve porosity is made worse. This leaves open several avenues of approach in obtaining acceptable quality. The usual technique is to compromise dry blending conditions and extrude with a shallow flighted screw. Another method is to produce a dry blend poor for "fish eyes" but low in porosity and use a valve to improve quality. The other is to produce a dry blend good for "fish eyes" but high in porosity and remove the porosity by vented extrusion.

This article will discuss reasons for valved extrusion and present several improved methods of valving along with experimental data showing results of valved extrusion on PVC quality. Also discussed will be a recent development by Monsanto, in conjunction with an extruder manufacturer, on the use of valves as a means of simplifying screw design problems associated with the vented extruder.

It has been known for some time that there is a direct correlation between product quality and the back pressure against which the screw operates. Increasing this back pressure moves the melt zone farther back in the extruder and results in a more thorough mixing. With PVC, this will normally improve the "fish eyes" and the porosity problem (due to air entrapment).

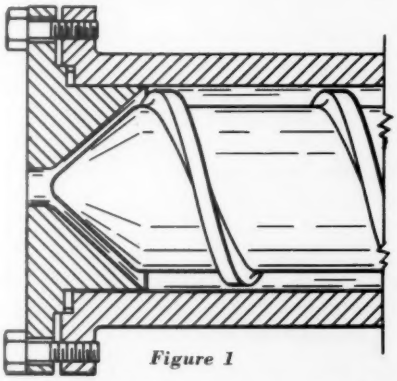
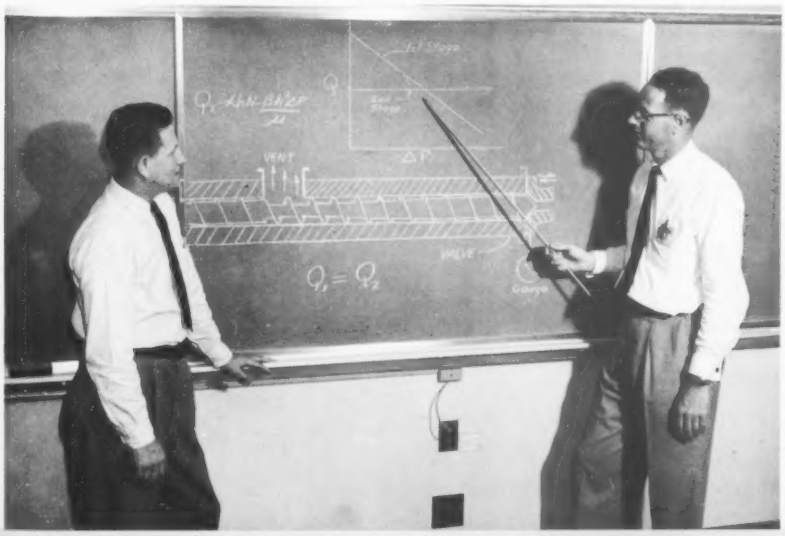


Figure 1

In a standard extrusion setup, the back pressure is determined by the shape of the extrusion die, breaker plate, screen sizes, screw design, and the viscosity of the plastic melt. Over a relatively narrow range, changes in screen packs will give increased die resistance and generally improve quality. Frequent changing of screens results in considerable loss of productivity and is a relatively crude method of controlling pressure. The precise contour of the die is dictated primarily by the shape of the article to be made and except for the length of the die land one has little control over back pressure. Thus, we have a process

(Reading left to right) E. H. "Ernie" Hankey, research department, and R. D. "Bob" Sackett, technical service specialist, conduct special session on valve extrusion for Monsanto personnel.



MONSANTO WIRE RECORDER
newsletter
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EARTHQUAKES, TIDAL WAVES, CORAL, EROSION, AND PIRATES ARE ONLY A FEW OF THE PROBLEMS CONFRONTING OCEAN CABLES THROUGHOUT THE WORLD. The laying of undersea telegraph or telephone lines has always been one of the most interesting - and one of the most difficult - tasks in the field of communications. At present there are more than 400,000 miles of international communications stretched across the world's ocean depths. The latest addition to this network, a rugged submarine telephone system of two insulated cables stretching some 2,400 miles between California and Hawaii, includes one bypass of a mountain 11,000 feet high.

CANCER TRACED WITH HELP OF ULTRASONIC ECHOES. A group of Japanese researchers recently discovered a method of diagnosing early cancer through the use of ultrasonic echoes from the human body. The echoes are produced by pulsating ultrasonic waves which are beamed into the body and then reflected by various internal structures. The method follows a pattern similar to radar operations.

THE LARGEST POWER GIANT IN THE EASTERN PORTION OF THE UNITED STATES IS ABOUT TO BECOME A REALITY, WITH NIAGARA FALLS ACTING AS A NATURAL DAM BACKED UP BY A RESERVOIR OF THE GREAT LAKES. The $600 million project will convert the tremendous water power of one of America's greatest scenic wonders into nearly 2 million kilowatts of electricity. The operation, scheduled for completion within three and one-half years, will divert waters of the Niagara River through tunnels some three miles above the Falls...without interfering with the beauties of the Falls. The use of wire and wire products will transmit this energy to the large industrial area of the northeast.

A RECENTLY DEVELOPED ELECTRONIC SCANNER NOW PERMITS THE SHOWING OF FORTY DIFFERENT PICTURES AT ONE TIME. The forty individual "pictures" may be viewed simultaneously through the use of a new product, known as a baragraph oscilloscope. The instrument is similar to a standard television set in its outward appearance; however, it performs the action of forty separate sets in combining the individual views.

ONE OF THE GREATEST ASSETS TO MODERN RAILROADS HAS BEEN THE DEVELOPMENT OF ULTRASONIC DETECTOR CARS WHICH INSPECT RAILS FOR DEFECTS. Estimates show savings of more than $400 million in prevented damage since 1943. A system of silent sound vibration frequencies is used to scan switches, frogs, rail ends and platform-covered rails to uncover defects.

NEW JERSEY TESTS ELECTRONIC DEVICE IN SELECTING JURORS. A machine which selects jurymen electronically was tried out recently at the Bergen County courthouse. A product of IBM, the device is capable of selecting eight jury panels of 275 names each within twenty minutes.

where quality is tied in very closely with back pressure, but one where under normal circumstances we have little control over back pressure when a wide variety of dies are used.

Where dies of large cross-sections are involved, it is sometimes necessary to slow down the output rate in order to obtain acceptable quality. It was soon realized that it would be desirable to have a pressure regulating device that was independent of the die itself. In polyethylene this was no particular problem as one did not need to be overly concerned with resin decomposition. In PVC, due to its heat sensitivity, greater consideration had to be given to the streamlining of the die.

The desirability of a pressure regulating device was first recognized by Monsanto in 1952 resulting in the filing of a patent application on the so-called "Hankey Pressure Head" in 1953. This patent was issued in November of 1956 (U. S. 2,770,836). The patent relates to an apparatus including an adjustable pressure head for use in the continuous extrusion of thermoplastic material. Figure I shows the basic principle of the device. The variable orifice in this simple case is obtained by either moving the extruder screw in and out or by placing spacers between the pressure cup and the cylinder.

There are a great variety of mechanical means in which the principles of this patent can be attained. The use of a conically shaped cup, as described in this patent, affords an effective streamlined method of regulating pressure over a relatively wide range. In those extruders where the screw can be advanced relatively easily, it is desirable to use this method of pressure control in conjunction with the pressure head. Figure II is a proposed method by which the "Hankey Pressure Head" can be set up for pressure regulation without shutting down the extruder. It is generally desirable to incorporate a large mesh screen with the pressure cup in order to collect any major contaminants and prevent die damage; and this has been included in Figure II. In the suggested method, the pressure cup is adjusted by means of several set screws. The adjustment could also be accomplished by means of hydraulically operated pistons in place of the set screws. The movement of the pressure head need only be very slight as it has been shown that in most pressure regulating devices, used for this purpose, increases in pressure of significant importance occur only in the final few thousandths of movement.

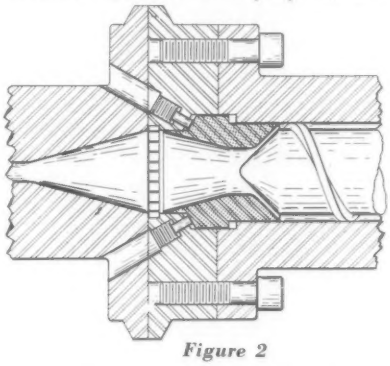

Figure 2

The effect of increasing die pressure on "fish eyes" and porosity in PVC dry blends is shown in Table I. A specially prepared dry blend was selected in order to illustrate the effects of higher pressure on quality. It should be noted that there is a definite reduction in "fish eyes" per gram and in the percent porosity (based on specific gravity) as pressure is increased. At higher back pressure, there is also an increase in stock temperature and a reduction in output. The purpose of this test was merely to show the improvement in quality with higher pressures and no attempt was made to maintain output rates. It should be obvious, however, that by the proper adjustment of screw speed and the pressure head that improved quality can be obtained at satisfactory output rates and this will be shown later.

Valves of the general type discussed are suitable for most applications. However, in the wire industry there exists a special problem. In this field the alignment of the crosshead die with the expensive (and substantially mounted) take-off equipment is critical. In Figure III is shown a valved wire die that does not cause any realignment problem as the valve is an integral part of the crosshead.

It has been suggested that the "tip" in a wire die can be used as a valve. This has the disadvantage that the spacing between the end of the leader and the back of the die has a minimum critical position. If the leader is moved closer than this, uneven flow results and unacceptable wire is produced. As pointed out previously, pressure regulation does not occur until the valve is almost closed and in this position the "tip" would be too close to the die. In our experience the maximum distance back from the die (within reasonable limits) is not critical. In Figure III as the valve is closed the "tip" spacing is changed. This did not, however, cause any difficulty and very excellent valving was obtained. Results of an experimental run made with this die are shown in Table II.

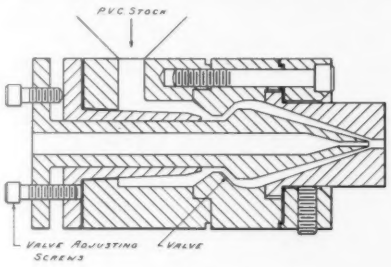

Figure 3

Figure IV shows a die incorporating the principles of the die covered in Figure III, but valve control is obtained without changing the "tip" spacing. In this suggested design either the valve or the "tip" spacing can be set independently.

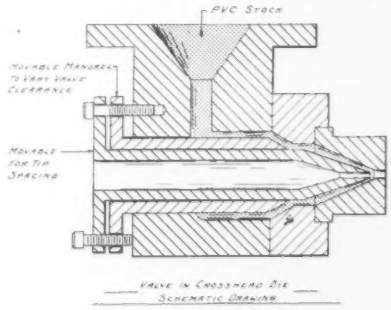

Figure 4

An important advantage of the valves described is that they do not limit output in those applications where for one reason or another valving is not required. It should be noted that there is a temperature increase as

pressure is increased; and, if screw speed is also increased to maintain output, there may be a still further temperature problem. The ability to maintain a high level of production at high back pressures assumes either the presence of screws with high pressure developing capacities or applications and equipment where higher screw speeds are mechanically feasible. As the techniques of valved extrusion are improved, there will undoubtedly be an increase in the use of this method of controlling product quality.

The vented extruder has been accepted for many years as a desirable means of removing volatiles from thermoplastics during the extrusion operation. Porosity (primarily entraped air) in PVC wire coatings has been a problem for several years and is especially troublesome in cable jacketing applications. The vented extruder has proved itself as a satisfactory means of reducing porosity in PVC.

The acceptance of vented extrusion by the wire industry has been slow — primarily because of the requirements they place on the vented extruder to perform over a wide pressure range. It is normal in the wire industry to operate a single extruder with back pressures from 200 psi to something in the order of 2500 to 3000 psi. The problem of balancing the two stages of a vented extruder are well known. Over a reasonable pressure range this is possible by proper screw design.

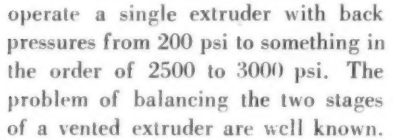

Figure 5

First let's review the operation of a vented extruder (Figure V). It is essentially two screws driven along a single shaft. Venting occurs at the feed to the second screw and the pressure at this point is zero. The second stage (or screw) must be capable of operating surge free at low die pressures and yet be capable of delivering full capacity of the first stage at high die resistance. Failure to perform the latter will result in flow from the vent. It has been previously pointed out that the output of an extruder varies directly with the pressure. This is only true on a single stage extruder. In a vented extruder, the output of the second stage depends on the output of the first stage and this is dependent in most cases on screw design.

Recognizing the fact that the output of a vented extruder is independent of die resistance (assuming no flow from vent), it became obvious that the screw design problem could be simplified by using a valve. In other words, it was no longer necessary to expect the screw to operate satisfactorily over a wide pressure range because the combination of the valve plus the die could always be set at the same pressure. The design pressure can be selected at the highest expected die pressure and then the screw designed to operate at this pressure. As dies with lower back pressure are used, the valve can be adjusted to bring the pressure up to design level.

We have briefly outlined the salient controllable points in valved and vented extrusion. Before all problems and questions can be answered, further comprehensive development work must be carried out. Recognizing its responsibility of servicing the vast vinyl industry, Monsanto is carrying out an extensive evaluation and development program with major extruder manufacturers to refine these techniques to the fullest extent. Subsequent articles will be published as soon as factual information has been compiled.

TABLE I

Pressure	Extrusion Rates lbs./hr.	Stock Temp. °F	"Fish Eyes" per gram	% Porosity
450	84	350	20	1%
850	77.5	352	5	.7
1525	65.3	360	3	.2
2100	54.1	365	2	0

2½" Extruder *Metering Section Flight Depth .125"*
16-1 L/D *50 RPM*

TABLE II

RPM	Sample No.	Press psi	Rate ft./min.*	Rate #/hr.	Stock Temp. °F	"Fish Eyes" per gram	Surf. Appear. Insul.
40	1	2150	318	119	360	84	NG
	2	2550	306	115	375	64	pass.-
	3	3000	221	83	385	0	good
80	7	1800	434	163	385	21	NG
	8	2500	372	140	400	0	good
	9	3000	313	117	415	0	good
100	10	2000	484	182	410	2	pass.-
	11	2500	413	155	415	0	good

2½" Extruder *Metering Section Flight Depth .172"*
20-1 L/D **#14 Wire 1/32 Insulation*

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MONSANTO CHEMICAL COMPANY
PLASTICS DIVISION — SPRINGFIELD, MASSACHUSETTS

Standardization of Torque Values For Stiffness Testing of Wires Used As Grid Siderods in Radio Tubes

by J. R. Howell
Engineer in Charge, Engineering Services
Parts Division
Sylvania Electric Products, Inc.
Warren, Pennsylvania

Purpose

The purpose of this paper is to develop torque values for stiffness testing of various wires employed as support siderods in grids for radio tubes. For the past several years the same torque has been used for testing the same diameter wire regardless of the material. The error in such techniques is readily seen when you consider two of these materials such as "A" Nickel and 4% Nickel Plated 1005 Steel. In addition to this "one" set of torques used by any one of the various Receiving Tube Plants throughout the industry, small differences exist between companies at certain diameters. The necessity of standardization of torques has been recognized by the various tube manufacturers and this problem is currently under discussion by one of the standardizing committees. Some of the fundamental relationships have not at yet been established by these committees and the purpose of this work is to develop and present these fundamentals.

J. R. Howell

This paper was presented at the Annual Convention of The Wire Association in Chicago, Ill., on October 15, 1957.

The author graduated from the University of Kentucky in 1950 with a B.S. degree in Electrical Engineering. He worked with the Navy Department, Bureau of Ordnance, from 1950 to 1953, specializing in Inspection and Quality Control of Electronic devices. He joined Sylvania in 1953 as a Quality Control Engineer on development of reliable component parts for subminiature radio tubes and was assigned to the Wire Plant in 1955 as Supervisor of Quality Control. He was appointed to his current position in October, 1956.

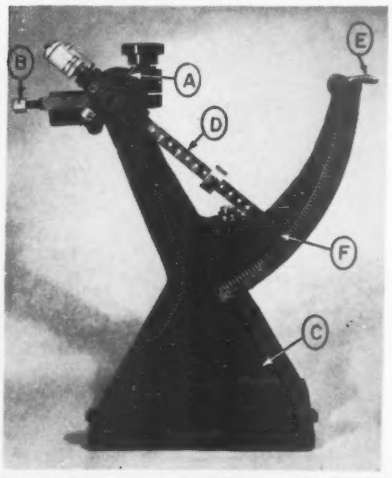

Fig. 1—Front view of stiffness tester showing the angle of bend scale, gram weights, positioning points for weights along the lever arm, and release lever.

Description of Test

Basically the stiffness test consists of a method of clamping a sample specimen of wire rigidly at one end, subjecting it to a bending force, and measuring the angle of bend. The testing unit in most common use is shown in Figures 1 and 2. A sample approximately two inches long is clamped into position as shown at "A" by use of knob "B." The bending force or torque is arrived at by selecting the proper gram weight "C" and positioning it along the torque arm "D," a known distance in centimeters from the axis of rotation. The torque is the product of the weight in grams and the distance in centimeters from the axis of rotation and is expressed in gram-centimeters. The lever at "E" is released applying the bending force to the wire under test. The bending angle is indicated by the pointer "F." The specifications call for a bending range of 30° to 60° at a given torque.

Siderod Materials

Figure 3 shows the construction of a radio tube and how the different components are located inside the tube. Three sizes of grids are shown for this particular tube. The siderod wires under discussion are marked "A" in Figure 3. The smaller diameter wire is known as lateral wire and is swaged into grooves cut in the siderod wire.

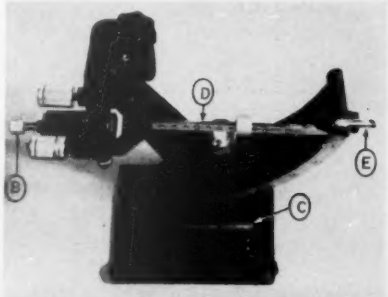

Fig. 2—Top view of stiffness tester showing slot for inserting wire sample.

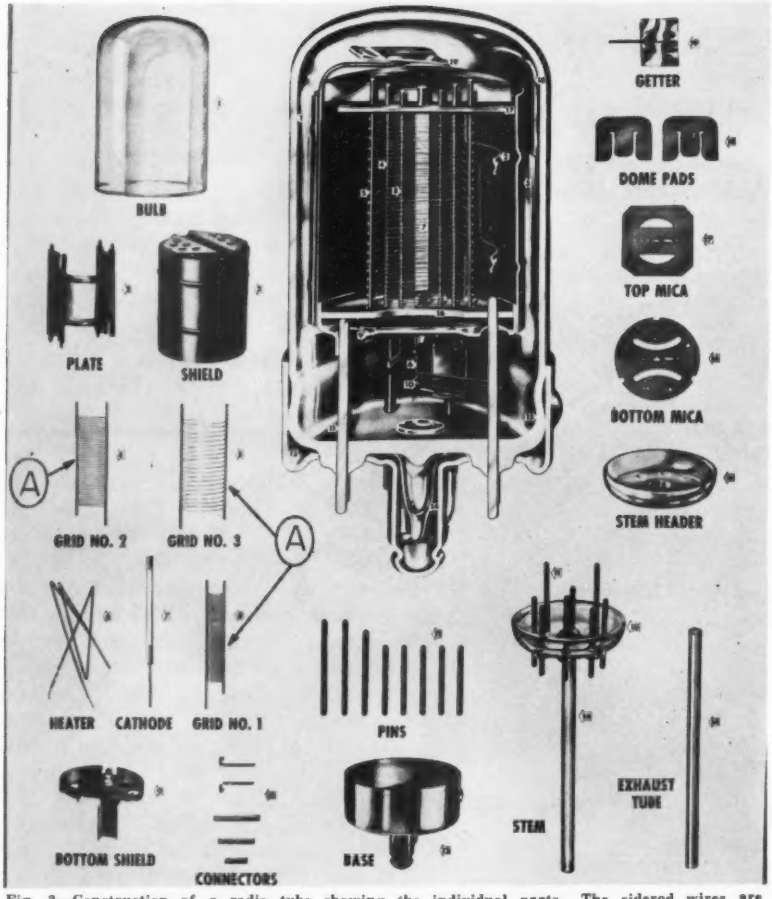

Fig. 3—Construction of a radio tube showing the individual parts. The siderod wires are identified as "A" in the above picture.

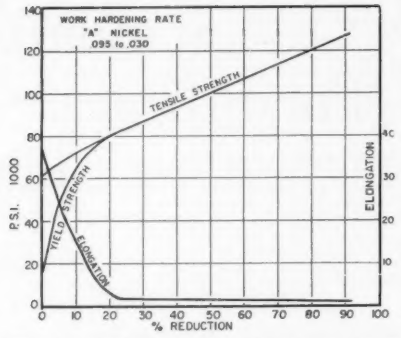

Fig. 4 — Effect of cold reduction on tensile strength, yield strength, and elongation of "A" Nickel. Material annealed at various sizes between .095" and .033" and drawn to .030" diameter.

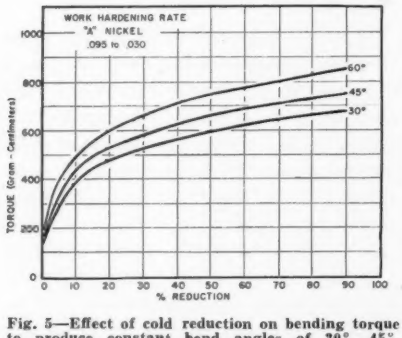

Fig. 5—Effect of cold reduction on bending torque to produce constant bend angles of 30°, 45°, and 60° on "A" Nickel. Material annealed at various sizes between .095" and .033" and drawn to .030" diameter.

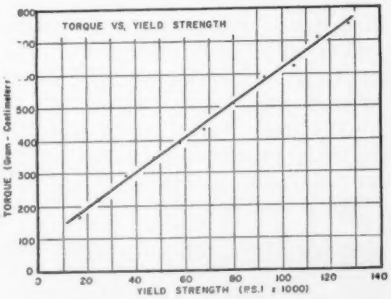

Fig. 6—Linear relation between torque in gram-centimeters and yield strength on .030" diameter "A" Nickel wire. This relation is for a constant bend angle of 45°

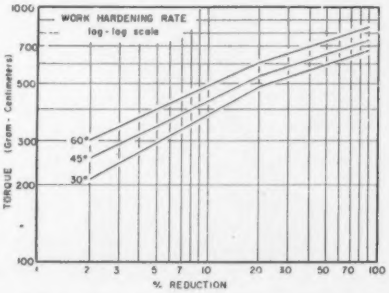

Fig. 7—Power law relationship between torque in gram-centimeters and % Reduction on .030" diameter "A" Nickel wire.

Some of the more common siderod materials in use include "A" Nickel, Copperweld, Nickel Plated Steel, Kulgrid, and Liquor Finished Steel. For the purpose of presenting the results of studies made for establishing basic relationships, "A" Nickel was selected. The same technique used in developing the "A" Nickel data was used in evaluating other materials.

Work Hardening Rate

Work hardening characteristic in terms of torque vs. percent reduction at constant bend angles of 30°, 45°, and 60° were determined. These properties were then compared with tensile strength and yield strength work hardening rates. Figure 4 shows the tensile strength, yield strength, and elongation vs. percent reduction and Figure 5 shows the work hardening rate in terms of torque for the constant bend angles. Comparing these two figures the similarity between the yield strength curve and the torque curve is very apparent. Plotting torque at a constant bend of 45° vs. yield strength from the data shown in Figures 4 and 5 results in the graph shown in Figure 6. Excellent correlation between torque and yield strength is shown by this figure.

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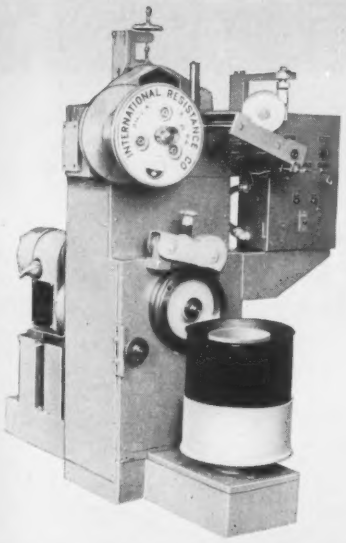
The majority of the applications of siderod wire are for soft annealed wire, therefore, the soft region, up to 20% reduction, of the torque work hardening curve was studied. It was found that in the range of 2% to 20% reduction the torque values for constant bend angles followed the power law. This region is shown on the graph in Figure 7. Although the slope changes, the torque work hardening rate also follows the power law from 20% to 90% reduction as shown in Figure 7.

COULTER & McKENZIE

CONSTANT TENSION DRAW-PAK EQUIPMENT

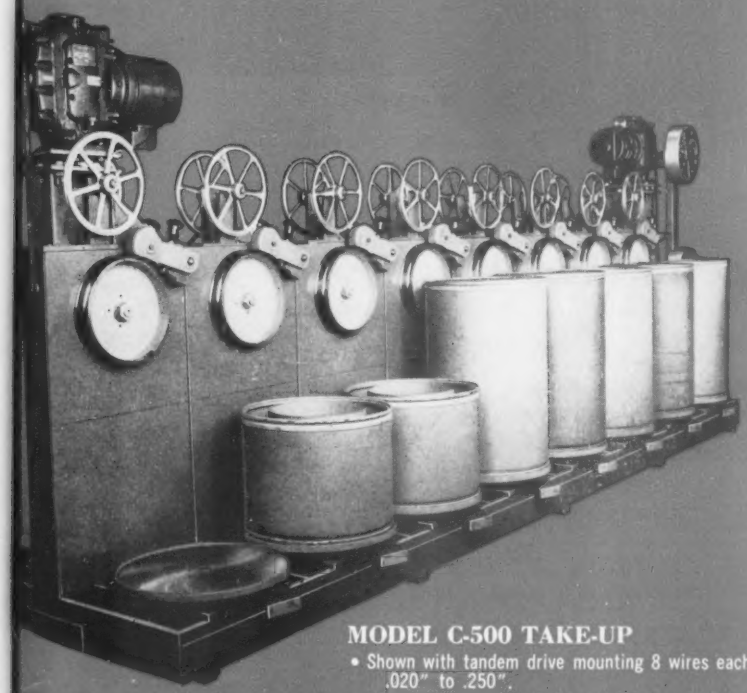
FOR CONTINUOUS WIRE PACKING & DRAWING



- Combination drum or spool take-up and rewinder.
- Shown for single wire.
- Adjustable for tension, pitch and amplitude of traverse.
- 12" spool shown. 30 to 150 lb. drums.

MODEL C-100 TAKE-UP

- Shown with single drive mounting to 16 wires .008" to .051"
- Enameling, annealing, galvanizing, tinning, etc.
- Containers 30 to 150 lbs.



MODEL C-500 TAKE-UP

- Shown with tandem drive mounting 8 wires each side .020" to .250".
- Galvanizing, patenting, enameling, etc.
- Drum or adapter weights 200 to 1,000 lbs.

MODEL 138-A DRAW BLOCK

- Single draft wires .016" to .375"
- "Draw-cast" die box shown gives adjustable positive cast control. Also available in other sizes.
- Process adapters to order — drums to 1,000 lbs.

Inquiry specifying the application which is of interest will result in prompt and courteous attention.

Pat. No. 2,732,060. Other U. S. and foreign patents pending.

35 UNION AVENUE

TELEPHONE EDISON 5-1101
LIEBER'S CODE "MACKENZIE"

THE COULTER & McKENZIE MACHINE CO., INC.

Another family of curves derived from this data is shown in Figure 8. These curves show the relationship of angle of bend vs. yield strength for constant torques. This family of curves also shows that the 30° to 60° bend range represents a yield strength range of approximately 20,000 psi on soft Nickel. On full hard Nickel wire this range increases to 30,000 psi.

Effect of Diameter on Bend Results

Another consideration is the effect of diameter on the angle of bend. It is easily recognized that the smaller the diameter, the larger the angle of bend for a given torque. Figure 9 shows this relationship of angle of bend vs. diameter for constant torques and constant yield strength on soft wire. At 200 gram-centimeters torque, the graph shows a difference in diameter of .0038″ results in a difference in bend of 30° which is the full normally specified range. At this diameter level each .0001″ change in diameter results in approximately a change of ¾°. Since most of the siderod wire is controlled to a diameter tolerance of ± .0003″, this effect for all practical purposes can be ignored.

Work Hardened Wire Due to Re-Spooling

Since siderod wire is normally batch annealed and then re-spooled to remove waves and meet physical properties, cold work takes place due to stretching the wire slightly. Wire, worked different amounts by pre-stressing with weights, was studied. The effect of this type work is shown in Figure 10 where angle of bend at a constant torque of 220 gram-centimeters vs. yield strength is plotted. As in previous graphs this chart shows the linear relationship between degrees bend and yield strength.

Establishing Torque Values for Different Diameter Wires

To establish torque values for the various diameters of siderod wires, several diameters from the same parent lot of material were drawn and annealed. These samples were annealed at the same conditions. Torques were determined for each diameter to result in a bend of 30°, 45°, and 60°. Diameter vs. torque plotted on log-log paper resulted in a straight line function showing that the established torques should follow the power law. This data for four different siderod materials at a constant bend of 45° is shown plotted in Figure 11. All materials tested followed the power law in the diameter range of .030″ to .055″. Other diameters of soft annealed material up to .085″ and down to .025″ were spot checked, using random samples from the production floor. By extrapolating this log-log function in these areas, excellent correlation was obtained in all cases.

★ ★ ★

As previously discussed, allowance should be made for cold work during spooling or re-spooling. Therefore, in setting the torque values for the various materials, the data from Figure 11 was adjusted by a factor of approximately 3,000 psi to allow for re-spooling. This results in the following table for torque values:

Wire Diameter (in inches)	MATERIAL "A" Nickel	Copperweld	4% Nickel Plated Steel	Kulgrid
.020″	50	70	80	30
.025″	120	140	160	80
.030″	220	250	280	150
.035″	380	420	460	260
.040″	600	630	720	420
.045″	900	920	1050	650
.050″	1300	1300	1500	920

★ ★ ★

The majority of these torque values can be obtained with one of the available gram weights at the proper distance; however, in a few instances two weights have to be used simultaneously.

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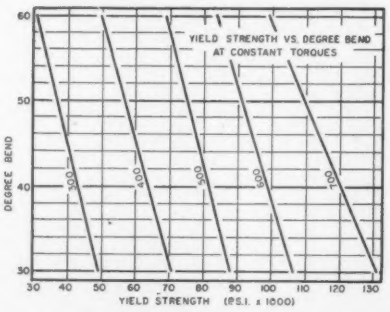


Fig. 8—Linear relation between angle of bend in degrees at constant torque and yield strength on .030″ diameter "A" Nickel.

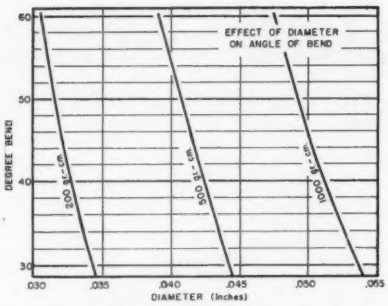


Fig. 9—Effect of diameter on angle of bend for soft .030″ "A" Nickel.

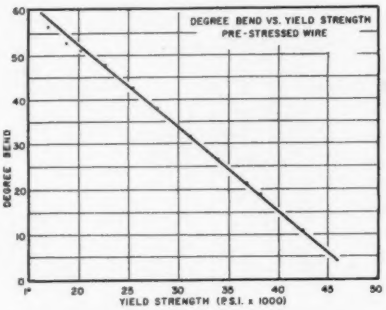


Fig. 10—Linear relation between angle of bend and yield strength on pre-stressed .030″ "A" Nickel.

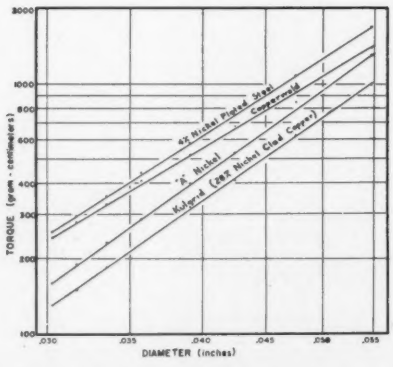
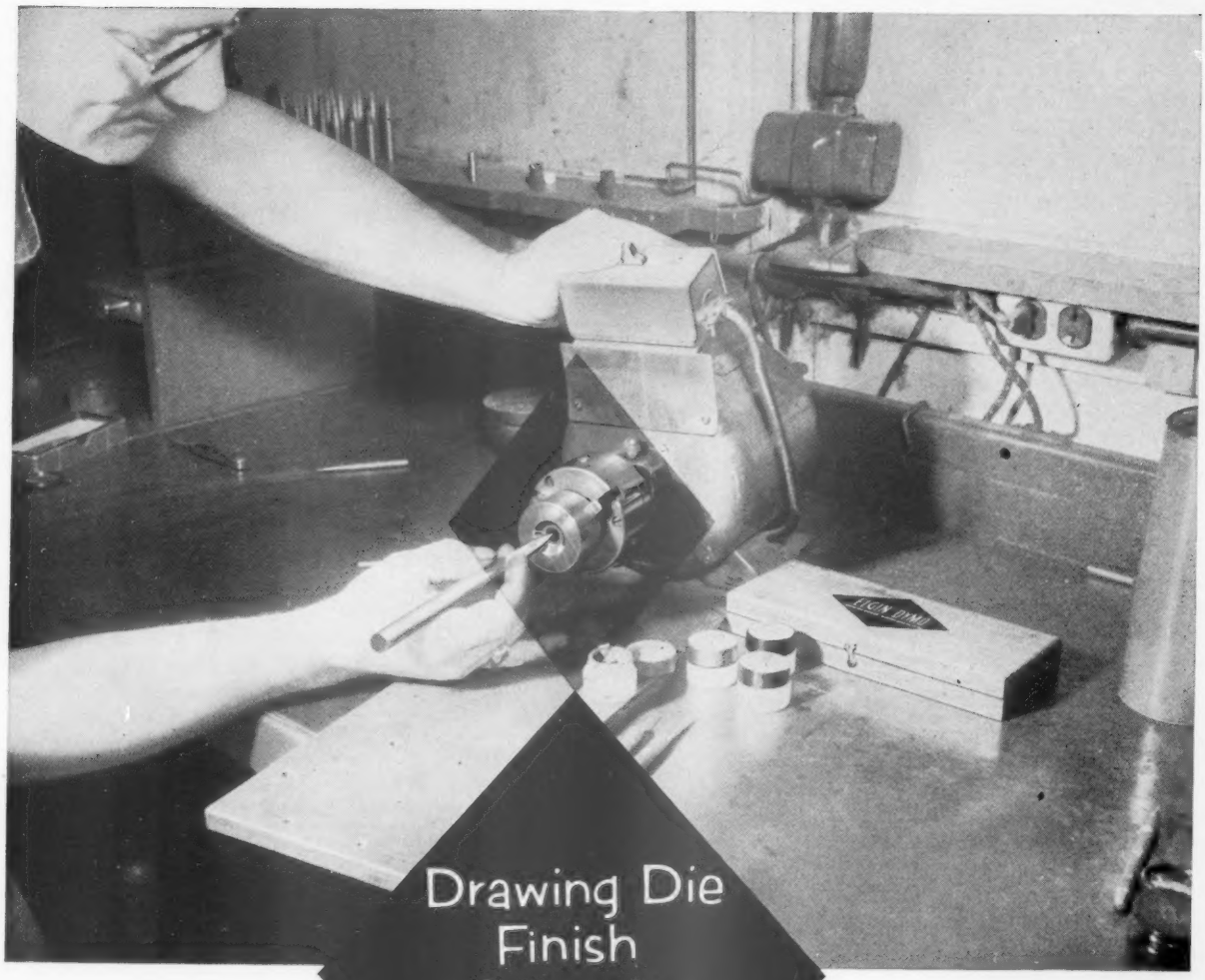


Fig. 11—Power law relation between torque in gram-centimeters and diameter on soft annealed "A" Nickel, 4% Nickel Plated Steel, "Copperweld" and "Kulgrid."



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*Name on request.

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ELGIN, ILLINOIS

Determination of Out-Of-Roundness On Ultra Fine Wire

by

Russell C. Nelson
Engineer-in-Charge
Metallurgical Laboratory

and

Harold I. Davidson
Supervisor, Service Group
Metallurgical Laboratory

Sylvania Electric Products, Inc.
Towanda, Pennsylvania

A description of a metallographic or microscopic technique for the determination of the degree of out-of-roundness and fissuring in ultra-fine wire.

Introduction

Out-of-roundness is an important property of both tungsten and molybdenum fine wire. One application where out-of-roundness is of prime importance is in winding grids for use in vacuum tubes. If the wire is very much out-of-round, it may shift its position as it is crimped into the side rods of the grid and thereby destroy the lateral or vertical spacing of the grid. In addition to its effect on wire application, the degree of out-of-roundness can be an indication of die uniformity in the wire drawing process.

★ ★ ★

Several years ago the Metallurgical Laboratory was requested to develop an accurate transverse measuring technique to determine the degree of out-of-roundness in tungsten wire less than 0.001 inche in diameter (<1.95 mg./200 mm). This request posed an interesting metallurgical problem for, in addition to being barely visible to the naked eye, wire in this ultra-fine size range has a strong inherent tendency to curl when not under tension.

★ ★ ★

A survey of the literature revealed several destructive test methods currently in use in which wire diameter was not a limiting factor. For example, most of the techniques were concerned with minimum wire diameters of approximately 0.005 inches, or five times the maximum diameter we wished to measure. All of these test methods employ one common technique, namely, heating the wire in an embrittling atmosphere, such as hydrogen saturated with either benzene or kerosene vapors, and then breaking off a piece for microscopic examination. For large wires this method has merit. However, we feel that the technique we have perfected for ultra-fine wire permits a greater degree of accuracy and is also adaptable to the mounting of specimens in which edge preservation and true positioning are essential. It can be extended to include larger wire sizes when more precision is necessary.

★ ★ ★

Since developing this technique we have received numerous inquiries for this procedure. Therefore, this article has been prepared for the benefit of others faced with a similar problem.

Equipment

The equipment necessary for this method is common to most metallurgical laboratories, and consists of the following items: (1) a specimen press; (2) a cut-off wheel; (3) rough and fine grinding facilities; (4) a final wet polishing wheel; and (5) a metalloscope or a metallurgical microscope with a micrometer eyepiece.

Mounting Procedure

Amber bakelite is used as the matrix in mounting the wire specimens for microscopic examination, for it is somewhat transparent and permits viewing of the embedded wires for perpendicularity to the plane of the sectioning of the plug. The amber bakelite is also a harder mounting material than black bakelite, giving good edge preservation when polishing hard metals such as tungsten and molybdenum.

★ ★ ★

The sequence of steps in this technique are depicted in Fig. 1, and illustrate the mounting of specimens of 20-mg. wire (approximately 0.00325 inches in diameter). In actual practice a larger number of specimens can be included in one mounting.

★ ★ ★

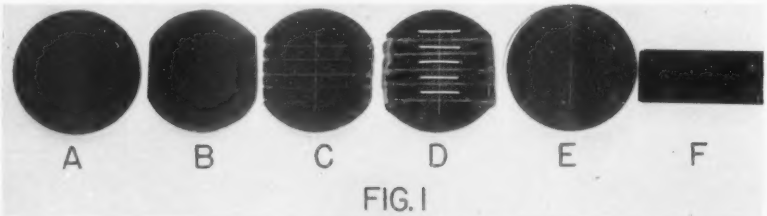

FIG. 1

Fig. 1—Steps in bakelite mounting preparation of wire for transverse microscopic measurements (mold diameter 1.250 inches) (L to R). A—initial mounting disc, B—ground parallel flats, C—scribe lines and notches for wire alignment, D—sample wire and spacer positioning by aid of induced wax in notches, E—final mounting assembly, G—sectioned, ground and polished for microscopic viewing.

Step A—shows an amber bakelite disc, or wafer, approximately 0.125 inches thick. These wafers can be precast in quantity by making an oversized bakelite mount and then sectioning to the desired thickness.

★ ★ ★

Step B—shows the same disc with parallel "flat" areas ground at opposite ends and perpendicular to the diameter of the disc.

★ ★ ★

Step C—serves to illustrate the scribe marks and filed notches which are used to align the specimens parallel to one another and thereby insures sectioning and polishing of the specimens perpendicular to the wire axis. The vertical scribe line appears on either side of the disc for additional accuracy in sectioning, although it is not absolutely necessary if clear bakelite is used.

★ ★ ★

Step D—shows the wire specimens in place prior to completing the mounting. This is the most exacting step in the sample preparation. Generally, three to four out-of-roundness checks are made per spool of wire, allowing several meters between specimens so that representative diameters are obtained. A small amount of beeswax, or paraffin, is placed in the filed notches to keep the wire specimens under tension and parallel to one another as they are mounted in place. Pieces of copper wire are inserted between wire specimens as spacers and also to serve as reference points for microscopic examination.

FIG. 2

Fig. 2—Illustrating opaque hazard created by excessive wax in mounting assembly or improper pressure and temperature in molding press.

It is important that only a minimum amount of beeswax or paraffin be used. Excessive wax will produce a milky appearance within the amber bakelite (see Fig. 2) and thereby destroy the desired transparency.

★ ★ ★

Step E—shows the completed plug, which is made by inserting the finished specimen disc in the mold, covering it with a thin layer of sieved (minus 60 mesh) amber bakelite and then adding regular (unsieved) bakelite to the desired height. The normal mounting procedure is followed, maintaining a pressure of 5,000 psi and increasing the temperature to 140°C. To ensure optimum results the pressure should remain constant from the time the desired temperature has been attained until the mount has cooled to 90°C, at which point it can be extracted from the mold. These temperatures and pressures were derived for a 1.25-inch diameter mold, and are important controls in this technique.

★ ★ ★

Step F—the final phase of preparation is to section the mount through the scribe line. Holding the mount up to the light enables one to ascertain if the cut will be perpendicular to the wire axis. After sectioning, the specimens are polished by the metallographic procedure normally used for the particular metal.

★ ★ ★

Measurement

Transverse measurements of fine wire require high magnifications and either a bench microscope with micrometer eyepiece, or oculars with calibrated reticules, is necessary. However, the metalloscope is preferable since it facilitates the measurement of the wire diameter. The image of the wire can be projected onto the ground glass screen and the diameter of the image measured with a millimeter rule. The percent out-of-roundness is calculated from the following formula:

$$\% \text{ OOR} = \frac{\text{Maximum Diameter} - \text{Minimum Diameter}}{\text{Maximum Diameter}} \times 100$$

The only source of error in this technique is the possibility of not sectioning the mount at right angles to the axis of the wire. A graph has been prepared (Fig. 3) to show the amount of error resulting from a non-perpendicular cut. The graph illustrates that accurate measurements are assured with this technique, since a deviation of 5 degrees from the perpendicular causes a change of only 0.5% in the out-of-roundness measurement.

★ ★ ★

Photomicrographs of four specimens of 0.60-mg. tungsten wire (0.00055 inches in diameter) are shown in Figure 4 at a magnification of 2500x to illustrate the degrees of out-of-roundness. Specimen A is 0% OOR, Specimen B is

(*Please turn to page* 1406)

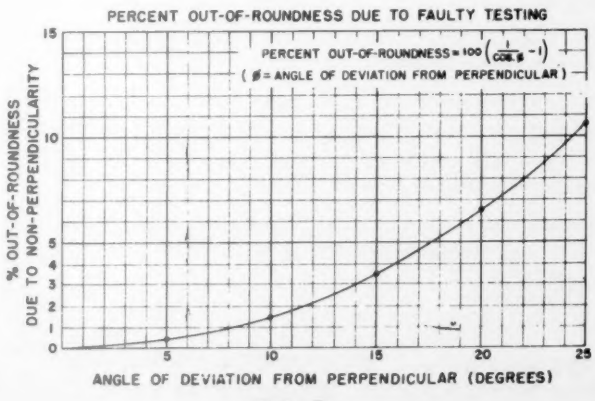

FIG. 3

Washington Report
by Larston D. Farrar

Congress, in the first session, took no steps designed either to help or to hurt any large group in the business community.

★ ★ ★

If there is one word to describe Congressional reaction to almost any "action program" this year, it would be "lackadaisical."

★ ★ ★

This attitude is based on the belief that, since the country is going along on a high economic plateau, there are few really dissatisfied groups, aside from the farmers, and among them, the small ones are being squeezed out.

★ ★ ★

Business, federal economists and Congressmen agree, will be extremely good in the last half—even better than in the first half. Individuals, as such or as businessmen, may suffer, but overall, personal income will continue to rise, corporate profits will be high and employment will inch up month-by-month.

★ ★ ★

Inflation is a bad word in Washington. It's like the weather. Everybody talks about it, but nobody knows what to do about it, from a governmental standpoint. Therefore, in the opinion of many, slow but steady inflation will continue.

★ ★ ★

The Treasury Department is putting out a new dollar, with "In God We Trust" on it, and Robert B. Anderson's signature as the new Secretary of the Treasury. But the dollar still is worth only 49 cents, compared to pre-World War II days. It'll be worth even less, in purchasing power, in a few more months.

★ ★ ★

Representative Wright Patman (D.-Texas) has pointed out that, for money-borrowing purposes, the dollar has plummeted to a value of only a few cents in the past several years. It costs the Treasury more than 100 times as much —in interest—for its 90-day bills as it did only a few years ago.

★ ★ ★

The National Labor Relations Board has announced that it ordered Imperial Wire Company, Inc., of New Haven, Ind., to withdraw and withhold all recognition from Magnet Wire Workers Union, Inc., of Indiana, as representative of employees, unless and until certified by the NLRB; to cease and desist from interfering with, restraining or coercing employees in the exercise of their right to self-organization; jointly and severally with the union, to offer back pay to one employee and to post compliance notices for 60 days.

★ ★ ★

At the same time, the NLRB ordered the union to cease and desist from causing or attempting to cause the company to discriminate against employees; from performing, enforcing, or giving effect to its collective bargaining

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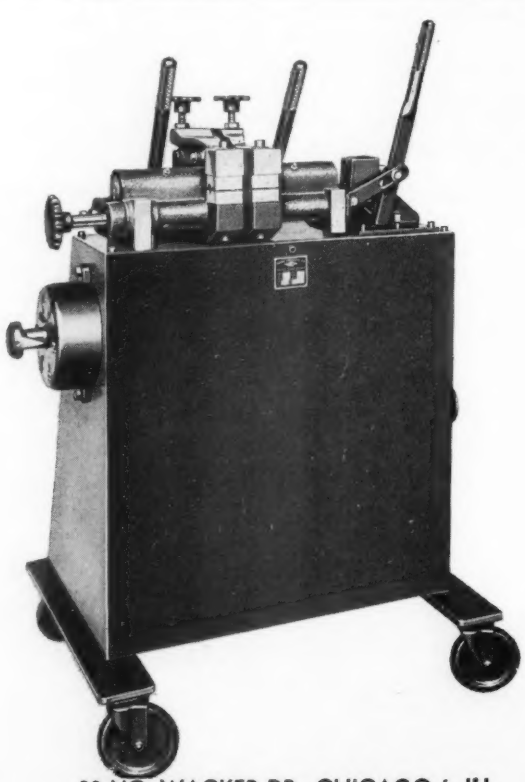
A general utility Butt welder for welding Steel low carbon rods and wire ranging in size from 1/8" to 7/8" diameter.

While this unit was not designed for production line work, the wide range in welding capacity makes it suitable for various types of welding requirements.

Equipped with hand-operated toggle type clamping mechanism, providing positive clamping of the stock. Spring actuated movable welding headpiece and close coupling of the transformer provides high efficiency on the welding current.

General construction of this unit is rugged to resist high upsetting forces, and to maintain accurate alignment of the work. Furnished mounted on 4-wheel-truck as illustrated.



MICRO PRODUCTS CO.,
20 NO. WACKER DR., CHICAGO 6, ILL.
Telephone: STATE 2-7468

agreement of November 7, 1955, with the company, unless and until certified by the NLRB, or from in any other manner restraining or coercing employees of the company in the exercise of their right to self-organization; jointly and severally with the company, offer backpay to one employee, and post compliance notices for 60 days.

★ ★ ★

The NLRB overruled a contract between the union and the company that, it said, would give employees only six days in which to join the union or to be fired. It said that both the NLRB and courts have found illegal union-security clauses to be severable, but that in this case a new contract must be negotiated.

★ ★ ★

The Small Business Administration, now doing a land-office business (by past standards), reports that it made almost 300 loans, totalling about $15 million, to small businessmen during June, and that the tempo of applications is being stepped up.

★ ★ ★

As the applications have come into SBA in increasing numbers, the qualifications, in effect, have been raised so that, percentage wise, the odds are greater against any particular company now than they have been before.

★ ★ ★

Democrats expect in '58 to make "tight money" their No. 1 talking point. It may prove to be politically dynamic, too, if the cost of borrowing continues to climb.

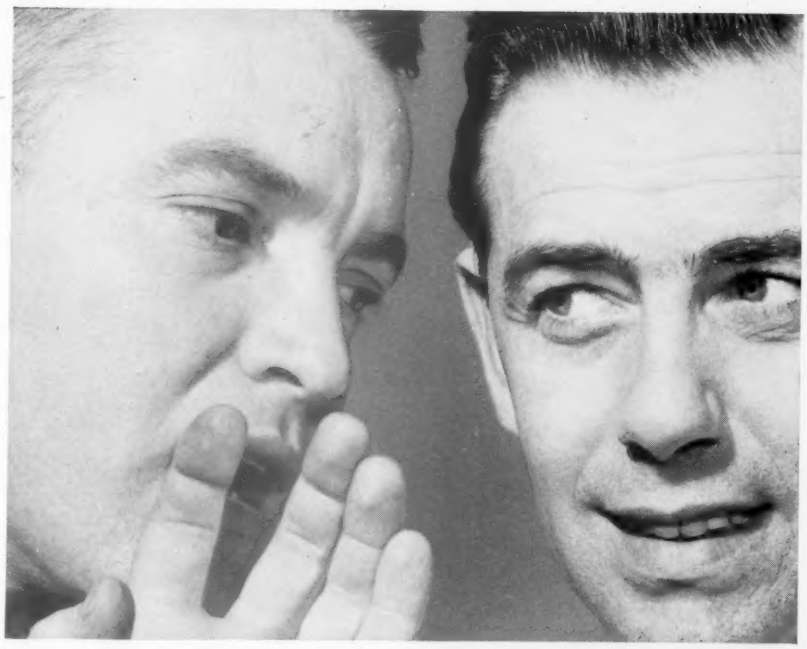
New Wire Drawing Compounds

The Industrial Soap Department of **Swift & Company** has announced a new line of metallic complex wire drawing compounds under the brand name "Flexal."

★ ★ ★

According to the company these new compounds are the result of a long range research and development program designed to seek out new means of achieving:

1. **Increased drawing speeds.**
2. **Longer serviceable die life.**



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Here's smoothness and luster you rarely get in tinned wire. Continental's special technique makes possible an enduring, uniformly bright finish . . . a wire so bright that it can replace plated wire on many products. It retains its brightness for long periods of time in normal use. Continental tinned wire meets your needs for quality and workability and is available in almost any temper and analysis in medium low carbon and low carbon steels.

FINE—16 gauge through 30 gauge, in 8″ diameter coils
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3. **More uniform wire color and finish.**

★ ★ ★

It was emphatically pointed out by company spokesmen that The Flexals have proven their ability in both laboratory and actual mill tests, and are now available from Swift. Sample shipments also will be made upon request.

★ ★ ★

Further details can be obtained by writing R. H. Causland, Swift & Company, Department F, Industrial Soap Division, 4115 Packers Avenue, Chicago 9, Illinois.

New Rewinder for Steel Wire

A new Rewinder for spooling steel wire from coils to reels has been developed by the **Wire Equipment Manufacturing Co.,** 1168 So. Olden Ave., Trenton 10, N. J. It is employed to wind strander bobbins with rope wire, galvanized core wire for ACSR cable, armoring wire and for similar applications where the wire is supplied in coils. The machine has a very high capacity, replacing several bulky and slow gang-type units and delivering a superior package with accurate winding tension and layering.

★ ★ ★

The unit has a specially designed swift that grips the coil of wire securely so that variable winding tensions from 0 to 100 lbs. can be effectively applied. Because of the unique construction of the swift and its braking system, the winder can be stopped rapidly without tangles or over-run of the coil.

★ ★ ★

The take-up is powered by a 7.5 H.P. variable speed drive that maintains a constant lineal winding speed variable from 400 to 1200 FPM. Reels up to 22″ in flange diameter and 600 lbs. weight may be handled. The reel is lifted between centers by a pneumatically operated cradle and the pintles are engaged into the reel bore by means of another air cylinder.

★ ★ ★

The traverse mechanism is infinitely variable. The rate of lay is steplessly changed by means of a handwheel. All gearing, clutches

and the speed variator operate in a sealed oil bath.

New Teflon* Extruder Announced

The Davis Electric Company, Wallingford, Conn., has announced the development of a completely new ram-type extruding machine for insulating wire with Teflon paste resin that embodies important new principles of design.

★ ★ ★

Two men who became associated with the company as development engineers, **John Davie and Theodore Palm,** are chiefly responsible for the engineering and design of the new extruder, which has been their first achievement.

★ ★ ★

A number of electric wire and cable men who have seen the machine in operation have expressed the opinion that this fine new machine is eminently suited to the commercial production of Teflon insulated wire. The machine has already proven itself in the field by the production of quality wire with fewer faults and at greater speeds than heretofore possible, thus providing much longer runs of good fault-free wire and permitting the mill to meet difficult specifications at lower costs.

★ ★ ★

Before the development work was started, the company made an extensive survey to determine the requirements needed for satisfactory Teflon extrusion. This brought to light the many difficulties that mills were having in this connection and the need for a machine that would overcome them. It is considered that the development work that followed has overcome 90% of these difficulties.

★ ★ ★

For a quarter of a century the company has been manufacturing the well-known Davis Sparker and other accessory equipment, such as capstans, pay-offs, take-ups, respoolers, etc., and it has been only logical that it develop this new line of Teflon extruding equipment to meet a pressing demand.

* Registered du Pont trade name.

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Offering great durability along with light weight, Textilene Twi-Tar is successfully used for buried communication cable (bedding and overall serving), expanded ACSR cable (expander between core and conductors), stationary power cable and portable cables.

Twitchell's superior Textilene line also includes: Moisture-resistant fillers — *Twi-Flex* and *Twi-Wax*. Used for non-metallic sheathed cable, maritime shipboard cable, varnished cambric cable.

Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all types of portable and flexible cords.

*Patent Applied For

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

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Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation—also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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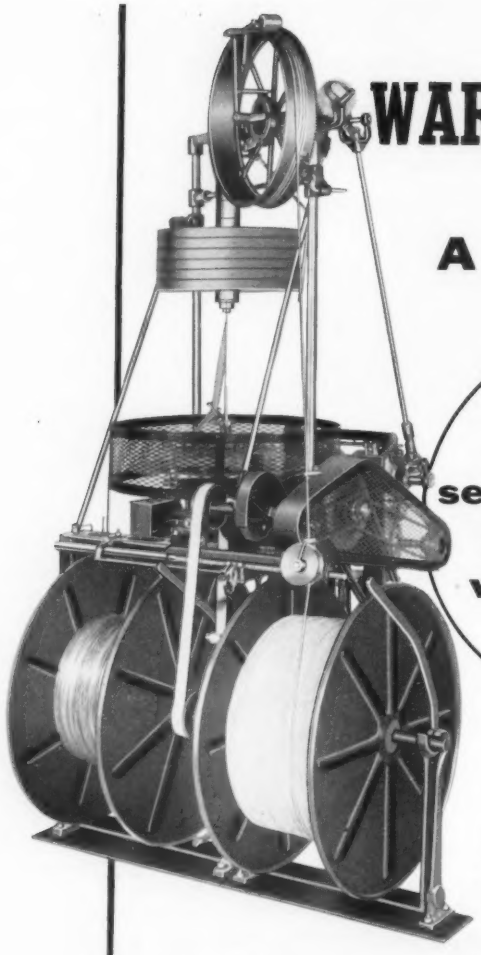

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- Adjustable for regulating lay of material.
- Rate of production dependent upon width of material and lay.
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- Motor drive furnished upon request at additional cost.
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- Reels not included with machine.

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FINE AND SPECIALTY WIRE

Bethlehem Steel Co. Materials in Design Engg 1957 Vol 46 (1) p 180 (July)

Steel wire as small as 0.007 in. diameter and shaped wire from 1/16 to ¾ in. is being produced by Bethlehem Steel Co. Fine wire is available with liquor, white liquor and coppered finishes, and electroplated with 99.9% pure zinc. 1 illustr.

DIE MACHINERY

E. Brand Ltd., 9 St. Cross Street, Hatton Garden, London EC 1. Wire Ind 1957 Vol 24 (283) pp 647, 649 (July)

Among a wide range of Urbanek machinery there is the universal grinding and polishing machine, model HPUK, for grinding and polishing tungsten carbide dies with bore diameters from 0.012 to 0.400 in. The 10-spindle diamond die polishing machine model TNP 53 is for bores from 0.01 to 0.19 in. The built-in needle grinding appliance can be stopped and covered by a flap, and there is a special device making the grinding of the polishing needles easier and more accurate. There is also a range of hand polishing machines for tungsten carbide dies. 3 illustr.

THE EFFECT OF 'TENSION-ACTIVE' LUBRICANTS ON THE WIRE DRAWING OF METALS. INFLUENCE DES LUBRIFIANTS TENSIOACTIFS SUR LE TRÉFILAGE DES METAUX

V. D. Chistota, S. Y. Veiler. Doklady Akad Nauk 1956 Vol 110 (4) pp 562-565; abstr Métall & Constr Méc 1957 Vol 89 (5) p 485 (May) (Original in Russian)

TRENDS IN THE CONSTRUCTION OF WIRE DRAWING MACHINES. ENTWICKLUNGSRICHTUNGEN IN BAU VON GROBZUEGEN

A. Krzeminski. Hutnik 1955 Vol 22 (9) pp 324-332; abstr Stahl & Eisen 1957 Vol 77 (14) p 960 (July 11) (Original in Czech)

WIRE DRAWING OF STEEL WITH GLASS AS LUBRICANT

G. Leclerc. Rev Gen Mecan 1956 Vol 40 (94) pp 369-374; (95) pp 423-428; Journ Am Ceram Soc—Abstr 1957 Vol 40 (7) p 160 (July 1) (Original in French)

The process of wire drawing, forces to be applied, and the advantages of using glass as lubricant are discussed in detail.

THE EFFECT OF SURFACE TREATMENT ON THE MECHANICAL PROPERTIES OF TUNGSTEN

K. Sedlatschek, D. A. Thomas. Powder Metall Bull 1957 Vol 8 (½) pp 35-40 (June)

3 illustr, 4 ref, 1 table.

THE LUBRICATING PROPERTIES AND THE TECHNOLOGICAL APPLICATIONS OF GRAPHITE AND MOLYBDENUM SULPHIDE. SCHMIEREIGENSCHAFTEN UND TECHNISCHE ANWENDUNG VON GRAPHIT UND

MOLYBDAENSULFID

F. Lihl. Berg & Huetten maenn M 1957 Vol 102 (5) pp 149-154 (May) (In German)

The crystal structure of graphite. Importance of chemical purity and particle size. Explanation of the lubricating action and applications. 5 illustr, 30 ref.

INFLUENCE OF RECRYSTALLIZATION ON THE DAMPING AND SHEAR MODULUS OF TUNGSTEN WIRES. EINFLUSS DER REKRISTALLISATION AUF DAEMPFUNG UND SCHUBMODUL VON WOLFRAMDRAEHTEN

W. Schilling, R. Haspel. Zeits Metallkde 1957 Vol 48 (1) pp 32-34 (Jan); Engg Index Service No 57-11824 (Original in German)

Influence of temperature on damping and shear modulus of deformed and recrystallized tungsten wire with additions of alkali silicates and thorium dioxide; effect of primary and secondary recrystallization.

STEEL WIRE PRODUCTS

VDEh Wire Working Comm. Iron & Coal Trades Rev 1957 Vol 174 (4642) p 1102 (May 10)

Book, Verlag Stahleisen, Duesseldorf, 1956, 2 volumes, 646 pp, 523 illustr, 92 tables. Price DM 70 (£6 10s Od approx). (In German).

The books deal with methods of manufacture and wire properties. The complete range of wire products is dealt with from wire in instruments to wire in prestressed concrete.

THE DEVELOPMENT OF THE IODIDE PROCESS OF REFINING TITANIUM AND ZIRCONIUM

R. A. J. Shelton (Manchester Univ). Metallurgia 1957 Vol 55 (331) pp 225-231 (May)

The van Arkel apparatus for the iodide process as developed in the Philips lab is shown diagrammatically. The filaments are thin tungsten wire. The hot filament technique is traced from the carbon filament lamp through the metal filament lamp and the preparation of single metal crystals to its application by Van Arkel (1923) to the purification of titanium and zirconium by the dissociation of the tetraiodides. 4 illustr, 27 ref.

ELECTRIC SPARK MACHINING OF WIRE DRAWING DIES

Z. Shteininger. Vestnik Mash 1956 Vol 36 (6) pp 48-51; DSIR CTS No 299 1957 6 pp (Mar) (Original in Russian)

Machines for the piercing of holes and the machining of cones in drawing dies are divided into two basic types: (a) machines with a vertical rotating tool holder spindle, a straight line motion of the tool electrode and a fixed die holding collet; and (b) machines with a horizontal rotating work spindle holding the die, and a straight line motion non-rotating tool electrode. Machines of type (a) mainly serve for piercing holes in dies and are not sufficiently accurate for repeated finish-machining of holes of diameters of 0.18 to 0.20 mm. Piercing a hole takes one or two hr as between three to ten hr in mechanical cutting. Inlet cones of dies are machined on a horizontal-type machine, which is also used for the repair of cracked dies. 7 illustr.

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Due to the ever-increasing demand for our spools and reels, we've had to make our second move in just two years! And in our new and spacious quarters we are manufacturing plywood. Since it's made especially for spools and reels, even better-grade products will result—CARRIS spools and reels, now QUALITY-CONTROLLED from plywood to finished spools and reels!
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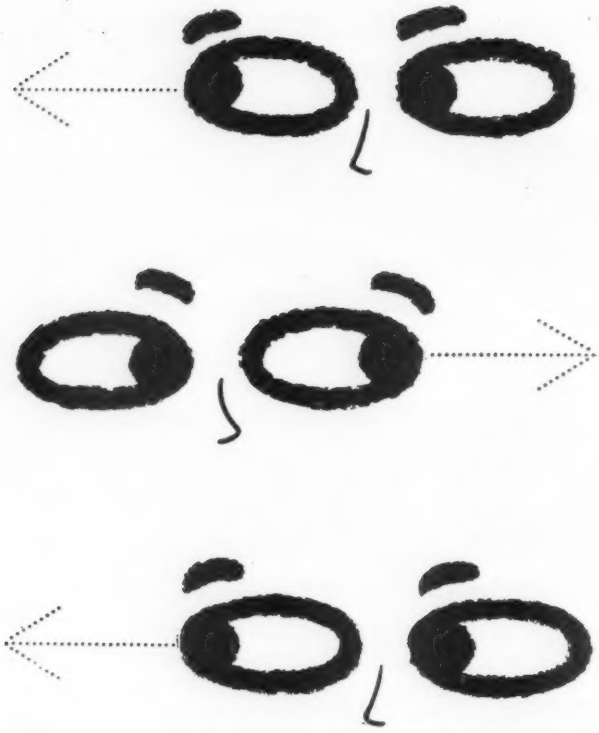

Alternating stresses bear watching!

Back and forth . . . up and down . . . in and out . . . if those stresses keep changing, the life of a metal part is a hard one . . . and often a short one. Stress reversals can cause "fatigue" failure at stresses far below the expected strength of the metal. One of the outstanding properties of phosphor bronze is its high resistance to fatigue failure. It is widely used for electrical switch parts, relay contact springs, bellows, rotating shafts and other moving or vibrating parts. For detailed information on phosphor bronze, write to Riverside-Alloy Metal Division, H. K. Porter Company, Inc., Riverside, N. J.

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RIVERSIDE-ALLOY METAL DIVISION

TEMPERATURE MEASUREMENT IN THE DRAWING OF STEEL WIRE. TEMPERATURMESSUNGEN BEIM ZIEHEN VON STAHLDRAHT. II

W. Lueg, K. H. Treptow. Stahl & Eisen 1957 Vol 77 (13) pp 859-867 (June 27) (In German)

See also Bibl Ind Diamond Appl 1957 Vol 14 p B28. Lecture to UDEL, June 22, 1956, Duesseldorf. Report 74 of the committee for wire working.

Investigation of the relation of the temperatures developed during wire drawing to several other factors. The temperature was measured with a wire-nozzle thermocouple and a split die. Lubricants graded according to temperature measurements fell into the same order as when graded according to measurements of the drawing force. In general a single value correspondence between temperature and drawing force was found.

By introducing a relative temperature T/F, where F is the contact area between wire and die, a cleaner and more coherent picture of the results is obtained. The temperature is found to be a function of the cubic root of the drawing speed. In the first stages of drawing a steady temperature is established after short lengths of wire whereas at later stages a steady temperature had not been reached after 150 m of drawn wire.

Experiments on 7 carbon steel wires with 0.34 to 0.99 deg C showed an almost linear relation between drawing temp and carbon content. 15 illustr, 24 ref.

NOMOGRAMS FOR THE DRAWING FORCE AND THE POWER REQUIRED IN WIRE DRAWING. NOMOGRAMME FUER DIE ZIEHKRAFT UND FUER DEN LEISTUNGSBEDARF BEIM DRAHTZIEHEN

Anon. Draht 1957 Vol 8 (6) pp 203-208 (June) (In German)

3 illustr, 5 ref.

WIRE DRAWING AND FABRICATING

Anon. Times Rev of Industry 1957 Vol II (126) pp 11, 13 (July)

General comment on some new techniques and machines.

BLANDS [?] FOR DRAWING MICRO DIAMETER WIRES

G. P. Gvozdyk, N. F. Andrianov. Metiz Proizv 1956 (1) pp 89-96; Library Congr Mthly List Russ Access 1957 Vol 10 (2) p 549 (May) (Original in Russian)

METALLURGICAL PROBLEMS IN THE DRAWING OF LIGHT METALS

E. Nachtigall. Berg- & Huettenmaenn Monatsh, Montan Hochschule Leoben 1956 Vol 101 pp 378-382 (Dec); Light Met Bull 1957 Vol 19 (14) p 509 (July 5) (Original in German)

Paper presented at the Third Internat Light Metals Congress, Leoben, June 1956.

Factors affecting the properties of drawn products are discussed, some being due to the material itself and others to pressure and reduction of the cross-sectional area during drawing.

USP 2,778,250 (JAN 16, 1951) A. W. PLOEGSMA, HARTFORD NATIONAL BANK & TRUST CO.

Enveloped diamond die and method of making same

The diamond is arranged with a flat part on a supporting plate. Plate and diamond are then placed in a mould. The mould is filled up with a material having the same melting temperature and the same coefficient of expansion as the plate. Diamond and plate are both preferably provided with a bore and the bottom of the mould is also provided with an aperture. The centre lines of bores and aperture should coincide in the mould. Through this aperture a vacuum is produced in the mould and maintained until the material poured into the mould has solidified to obtain a homogeneous casting which may be of cast iron with a 3% silicon content. (1 claim, 1 illustr). Ref: 13 USP; 1 BP.

Firm Organized to Manufacture Wire Forming Equipment

Latest to enter the field of supplier to the wire products industry is **Wire Machinery Incorporated,** located at Southview Avenue, Danbury, Conn. Incorporation papers were filed in Hartford in August by R. E. Seibert, W. C. Rockwell and T. Clark Hull, all of Danbury.

★ ★ ★

The company plans to put into production this fall the first in a new series of light duty wire working machines designed specifically for the replacement of hand operations in the small shops. The machines also will be offered to larger shops on the basis of releasing heavier duty machines from production of light wire items.

★ ★ ★

A simple bender, operated by air cylinder, has been designed to handle up to 12 No. 8 wires at one time or one wire up to ⅜" diameter. This will be followed by a wire trimmer and a wire ring roller, all designed to provide efficient automation at reasonable capital investment.

Announces New Carbide Catalog

Firth Sterling Inc. announces a new 56 page catalog on carbide tips, tools and inserts. A picture index easily identifies each product, and the pages have been die cut to expose the beginning of each section. A complete grade selection chart is included. Authorized Firth Sterling distributors are listed. For a copy, please write the company at 3113 Forbes St., Pittsburgh 30, Pa.

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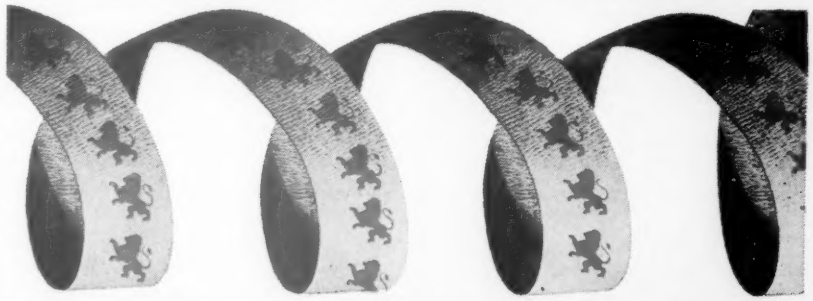

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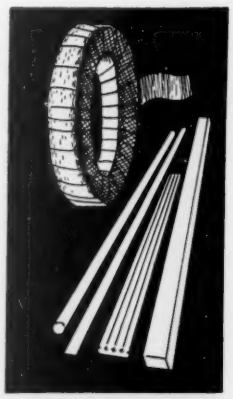

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Outstanding Personalities of the Wire Industry

Rockbestos Appoints Sales Manager

Richard H. Bamford has been appointed sales manager of **Rockbestos Products Corp.**, manufacturers of insulated wire and cable, it was announced by **Albert S. Redway**, president.

★ ★ ★

Mr. Bamford has been assistant sales manager since January 1953, and will continue to report to **H. O. Anderson**, vice president in charge of sales. He joined the company 18 years ago in New Haven. He was assigned to the Detroit Sales Office of the company for three years, and was made manager of the St. Louis Sales Office in 1949.

Atlas Steels Appoints Metallurgist

The appointment of **Harold B. Chambers** to the position of Director of Metallurgy, **Atlas Steel Limited**, Welland, Can., was announced by President **H. George De Young.** Mr. Chambers will head all metallurgical research and development, process metallurgy, service metallurgy, market development, inspection as well as chemical and physical laboratory controls.

Bakelite Appoints Man to Boston District

The appointment of **George L. Dougherty**, as a technical representative for the Extrusion Materials Division in the Boston district office, is announced by **Bakelite Company**, Division of **Union Carbide Corp.**

★ ★ ★

In his new assignment he will be responsible for the sale and service of Bakelite polyethylene, vinyl, polystyrene and fluorethene extrusion resins in the territory that includes Boston and Worcester, Mass.; Portland, Bangor and the rest of Maine; Concord, Manchester and the rest of New Hampshire; Burlington, Rutland and the rest of Vermont.

To Manage Silicone Sales in Chicago

S. F. Long has been named manager of the Chicago District sales office of the **Silicone Products Dept., General Electric Co.**, by **J. T. Coe**, department sales manager. His office is at 840 S. Canal St., Chicago 80.

★ ★ ★

One of the department's senior salesmen, Mr. Long has been transferred to Chicago from the department's Boston office where he was located for nearly 10 years. He joined General Electric in 1947 and became part of the silicone operation after various assign-

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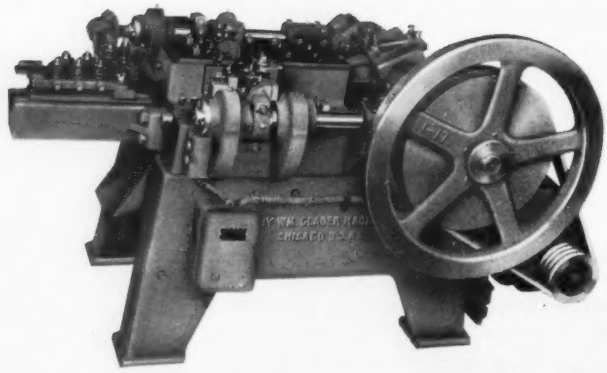

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ments on the company's training program for engineers. He obtained his degree in mechanical engineering from Rhode Island State College in 1947.

Appointed to G.E.'s Chemical Materials Department

The appointments of **Richard E. Hoverter** to the post of technical service engineer and **Kenneth W. Raymond** as specialist, product development, in the west coast section of **General Electric Company's** Chemical Materials Dept., were announced recently by **H. C. Nelson, Jr.,** engineering supervisor

★ ★ ★

"These new positions," Mr. Nelson said, "will enable us to offer increased services to our customers in the plastics industry, through integrated development of new products, and maintenance of high performance standards for the existing polyester product line." Both men are located at the Company's Anaheim Plant, 1211 North Olive St., Anaheim, Calif.

★ ★ ★

G.E.'s Anaheim Plant manufactures Glyptal (R) alkyl resins for the paint industry and polyester resins for the Plastics industry.

Grace Appoints Manager of Baton Rouge Plant

W. R. Grace & Co.'s Polymer Chemical Division has appointed **Julian A. Rogers** head of the Manufacturing Department of its high density polyethylene plant in Baton Rouge, La.

★ ★ ★

Mr. Rogers was formerly head of the ammonia department of Grace Chemical Company in Memphis, Tenn., where he was responsible for the start-up operations of Grace's 250 tons per day ammonia plant and continued as department head for the first three years of production of the plant.

★ ★ ★

He attended Peabody College and Southern Methodist University where he studied mechanical engineering. Prior to joining Grace, Mr. Rogers was ammonia plant superintendent of Mississippi Chemical Corporation from 1950 to 1952.

American Chain & Cable Appoints as Division Sales Manager

Joseph N. Kemple has been appointed to the position of sales manager, **Page Steel and Wire Division, American Chain & Cable Co.,** Monessen, Pa., according to an announcement recently made by **Harvey W. Seymour,** general manager. Mr. Kemple takes over the sales duties of **W. H. Bleeker** who retired on March 31 after more than 40 years of service with ACCO

★ ★ ★

A graduate of Stanford University, Palo Alto, Calif., class of 1947, with a B.S. and M.S. in Industrial Engineering, Mr Kemple joined Page Steel and Wire after resigning as Manager, Wire Rope and Electrical Wire Sales, Columbia-Geneva Steel Div., United States Steel Corp., San Francisco, Calif.

SCHUMAG
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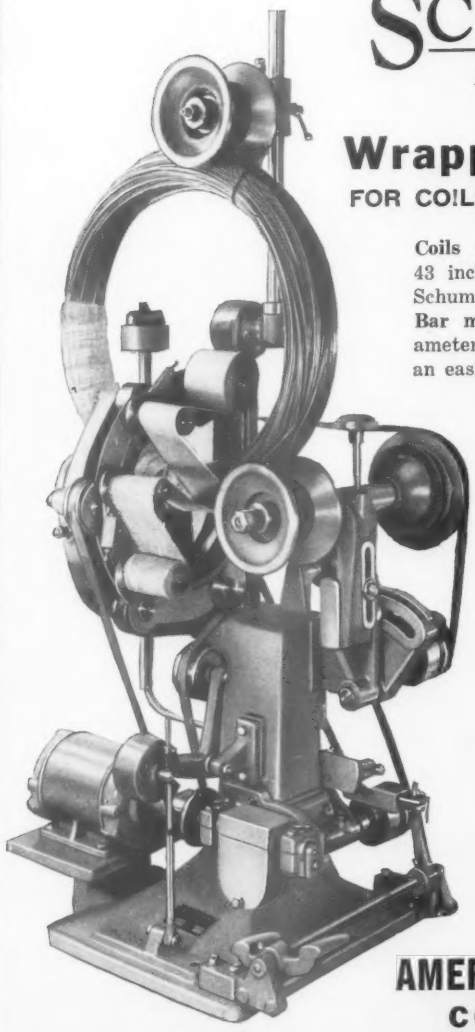
Wrapping Machine
FOR COILS, BARS AND BUNDLES



Coils with outside diameters up to 43 inches are handled by the basic Schumag WS 2a machine illustrated. Bar material up to 6 inches in diameter is handled by the addition of an easily attached auxiliary device.

Outstanding Features

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Purbaugh Promoted at A S & W's Duluth Plant

Promotion of **C. A. Purbaugh** to the newly created post of assistant manager of operations of **American Steel and Wire's** Duluth district was announced recently by **Harry L. Jenter,** operating vice-president of that division of **U. S. Steel Corp.**

★ ★ ★

"Cap" Purbaugh was general superintendent of the Wire Division's Duluth Works. He attended Pennsylvania State University and the University of Pittsburgh being graduated from the latter with a B.S. degree in metallurgy. He began his career with American Steel and Wire in 1935 as a clerk at Donora. Advancing to the position of foreman, he was transferred to Duluth as assistant works metallurgist in 1941. In 1945, he was made open hearth division superintendent and on January 1, 1950, became general superintendent.

He is succeeded as general superintendent by **Jacob W. Cox,** who is moved from Donora to Duluth. Mr. Cox is a graduate of Carnegie Tech with a degree of B.S. in M.E. He joined the company in 1936.

Silicone Marketing Manager Named by GE

Jerome T. Coe has been appointed manager of marketing for the **Silicone Products Department, General Electric Co.,** Waterford, N. Y., by **Dr. Charles E. Reed,** general manager. He succeeds **T. C. Ohart** who has become general manager of General Electric's Insulating Materials Section.

★ ★ ★

Most recently assigned as sales manager, Mr. Coe has been associated with the silicone operation since 1946. Other previous assignments include those as manager of sales development, customer service supervisor, manager of manufacturing engineering, and manager of process development. He joined General Electric in 1942 after graduation from Massachusetts Institute of Technology.

Plastoid Names Technical Director

J. Leon Brodsky has been named to the staff of the **Plastoid Corporation,** Hamburg, N. J. Mr. Brodsky, who becomes Technical Director in charge of design, research and development and quality control, was with the **Federal Telephone & Radio Co.,** IT & T Division, Clifton, N. J., for 15 years and since 1949 had served as Chief Engineer of Federal's wire and cable component division. Prior to joining Plastoid, he has worked on dielectrics, research, practical application, design, and R.F. and U.H.F. measurements in the field of wire and cable for private industry, armed services and the Atomic Energy Commission.

★ ★ ★

Plastic Firm Names Plant Manager

J. Guy LaVergne has been promoted to chief engineer of **Escambia Chemical Corp.** in Pensacola, Fla., it was announced by **Ralph M. Brown,** plant manager.

★ ★ ★

He joined Escambia in August, 1955, as chief design engineer. His background includes experience as inspection engineer and design engineer with petrochemical companies in the United States and Canada.

★ ★ ★

He graduated from the University of Toronto with a B.S. degree in chemical engineering and holds a certificate in business adminstration from McGill University of Montreal, as well as a certificate of corrosion engineering from the University of Illinois.

Rockbestos Moves Pittsburgh Office

Rockbestos Products Corporation, wire and cable manufacturers in New Haven, Conn., have changed the address of their Pittsburgh office to 2520 Koppers Bldg., Pittsburgh 19, Pa. The telephone number, ATlantic 1-4486, remains the same.

★ ★ ★

Robert R. Scott has been appointed Sales Engineer for this area and will assist **J. S. Rashba,** District Manager, in the Pittsburgh territory.

Joe Conlan Buys Wire Firm

Joseph F. Conlan, formerly Controller of the **K. H. Davis Wire & Cable Corp.,** Los Angeles, recently resigned and purchased the **City Wire and Iron Works, Inc.,** 3706 Avalon Blvd., Los Angeles 11. He will be President and Treasurer, with **Keith V. Jones** Vice President and **Natalie S. Conlan,** Secretary.

★ ★ ★

Joe had been with the Davis firm from its inception, starting with the late **K. H. Davis, A. F. Luhrs** and the late **James L. Morgan** in 1936. Prior to that he started in 1931 with the **Wickwire Spencer Steel Co.** in San Francisco as Warehouse Superintendent. In 1932 he joined **Earl R. Potter** and **Ken Davis** to operate the **Standard Wire Corp. of California,** which they sold to the **California Wire Cloth Corp.** (now CF&I) in 1934. **Ken Davis** and **Joe Conlan** left in 1935 to organize the Davis Wire Mill.

★ ★ ★

The City Wire and Iron Works was established in 1909. It manufactures the **Trojan Brand** wire cloth and screening in steel, brass, bronze, copper, stainless steel, monel, aluminum alloys, etc., and distributes wire cloth in meshes and sizes not made by the company. The company also produces diamond mesh windows, door guards and partitions.

★ ★ ★

Joe's many friends will wish him the fullest measure of prosperity in this venture, which his long experience eminently qualifies him to carry on successfully.

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Just name the type treatment—such as wax, jute saturant, anthracene—to meet your moisture and fungi control requirements, and see the difference Plymkraft can make. Plymkraft is made to fit your particular standard of manufacturing. Its greater fill capacity, greater uniformity, save you time and money in a better looking cable. Smooth running Plymkraft is also ideal for high-speed cablers where extra strength is a must. Use Plymkraft Cable Filler for cleaner, more efficient cabling.

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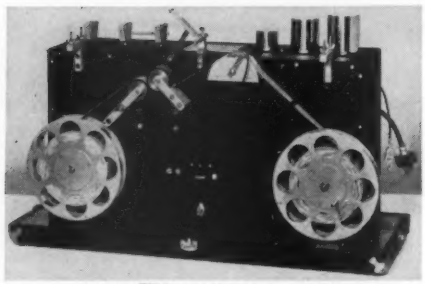

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The **JANCO** Abrasive Insulation Tester No. 1700 is specifically manufactured to MIL-T-5438. As a LABORATORY STANDARD, this system provides an abrasion resistance comparison of insulation for aircraft electronic wire and cable in accordance with the following specifications:

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Ruggedly designed and portable for field use, the **JANCO** Tester is ideally suited for laboratory, production and receiving inspection applications.

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- BUS ASSEMBLIES
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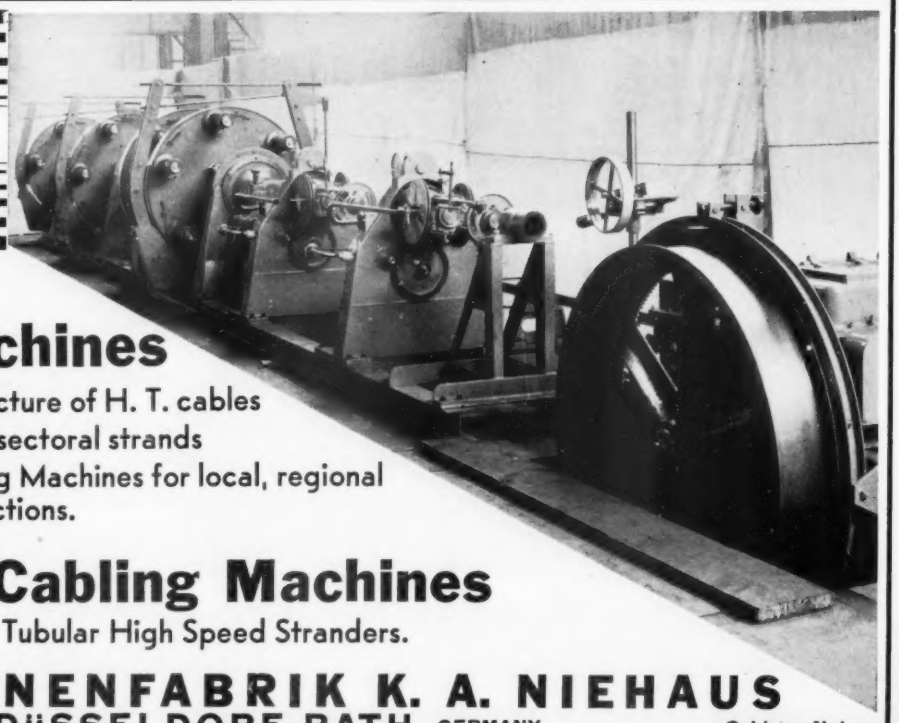

Cabling Machines

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Machines for pretwisted sectoral strands
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Wire Rope Cabling Machines

Rope Closing Machines. Tubular High Speed Stranders.

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Baessler Advanced by CF&I

Karl H. Baessler has been appointed director of wire product development for the Colorado, Wickwire Spencer, and Pacific Coast Divisions of **The Colorado Fuel and Iron Corp.**, it has been announced by **A. F. Franz,** president.

★ ★ ★

Mr. Baessler has been associated with CF&I since 1934 when he began work for the **California Wire Cloth Corp.**, now the Pacific Coast Division of CF&I, as a wire weaver. He has held various supervisory positions and since 1949 has been works manager of the Pacific Coast Division. He will continue to make his headquarters at CF&I's Oakland Plant, 1080 19th Avenue.

★ ★ ★

Mr. Baessler is a member and former West Coast Director of The Wire Association. He received his BS Degree in Electrical and Mechanical Engineering in 1934 from the University of California, and holds a life membership in the University of California Alumni Association.

To Represent Three Companies in New England

Standard Mill Supply Co., Providence 1, R. I., has announced the conclusion of arrangements with three machinery manufacturers, under which the company has exclusive representation for them in New England.

★ ★ ★

These concerns are the **Atlas Electric Devices Company** of Chicago, Ill., the **Fidelity Machine Company** of Philadelphia, Pa., and the Keller Tool Div. of **Gardner-Denver Company** of Grand Haven, Mich.

★ ★ ★

In addition to sales representation, Standard will handle service of equipment for these firms in the area.

Grace Appoints Three at Clifton

W. R. Grace & Co.'s Polymer Chemicals Division has announced the appointment of three new men to its Clifton, N. J. applications laboratories.

★ ★ ★

Norman F. Smith, formerly with Monsanto Chemical Company in Canada and Springfield, Mass., has been appointed technical representative of the Marketing Department.

★ ★ ★

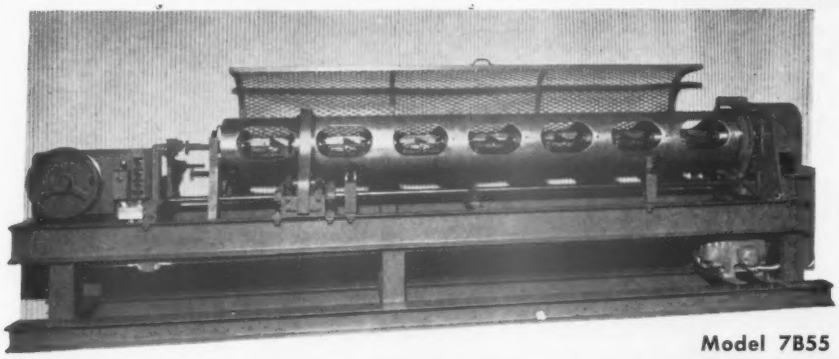
Albert Spaak, formerly chief engineer for DeMattia Machine & Tool Co. in Clifton, N. J., and chief engineer for Mastro Plastics, Bronx, N. Y., has been appointed injection molding engineer for the Technical Service Department.

★ ★ ★

Ruben Thevenet will be assigned to the Technical Service Department as a plastics extrusion engineer.

SEVEN BAY HI-SPEED STRANDER

Stranders also available with 6, 7, 12 or 18 bay construction



Model 7B55

DESIGNED AND MANUFACTURED FOR ARMY SIGNAL CORPS WD-1/TT FIELD WIRE EQUIPMENT PROGRAM

Introduced in 1951 and has received wide acceptance . . . users report SUPERIOR performance. A departure from 50 years of steel barrel construction . . . utilizes the latest high strength aluminum alloy barrel . . . eliminates useless weight, increases speed, and reduces operating costs.

For complete information write to . . .

BARTELL

BARTELL MACHINE-TOOL CORP.

ROME, NEW YORK

Serving the Wire Industry Since 1940

Institute Elects Officers

Wayne O. Stoughton, has been elected president of the **Wire Reinforcement Institute** for the coming year and **Earl C. Planett** of Downey, Calif., was elected vice president. The national trade association of steel welded wire fabric manufacturers voted the two men into office at the recent annual meeting.

★ ★ ★

Mr. Stoughton, a Princeton graduate, is Manager of Sales, Pittsburgh Steel Products, a Division of **Pittsburgh Steel Company,** and Mr. Planett is president and owner of the **Planett Manufacturing Company.**

Shifts Made at TC&I

Promotions announced by U. S. Steel's **Tennessee Coal & Iron Division** places new general superintendents at the company's two largest mills. **Dudley Vaughan,** formerly general superintendent of the **Ensley Steel Works,** has been made general superintendent of the **Fairfield Steel Works,** succeeding **J. J. Phifer,** who becomes assistant to the manager of the production planning division. Moving to the **Ensley Steel Works** as general superintendent is **George D. Brengelman,** former assistant general superintendent of the Fairfield Works. **Haran W. Bullard,** assistant to the manager of manufacturing operations, steps up to assistant general superintendent of the Fairfield Works. **John J. Shannon** continues as assistant general superintendent at Ensley.

Far greater production in less space with lower cost equipment . . . for all steel and non-ferrous wire.
The fastest, most uniform way to heat treat wire* is often far lowest in cost!
AJAX
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electric SALT BATH furnaces
* Write for case history bulletins on Ajax Electric Salt Baths for
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Waterbury Farrel Promotes Sciullo

The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., builders of metalworking machinery, has announced the appointment of **C. Vincent Sciullo** as Assistant Manager of the Cold Heading Machinery Division. The Manager of the division is **Harry R. Lange.**

★ ★ ★

Mr. Sciullo returns to the company's home office from Cleveland, Ohio where he has been Manager of the Cleveland Sales Office since early 1956. He has been with the Company since 1936.

New Regional Offices Opened by Kaiser

Kaiser Aluminum & Chemical Sales, Inc. has established six geographic sales regions throughout the nation to provide more efficient and direct service to customers, it has been announced by **Jack W. Watson,** general sales manager.

★ ★ ★

The regions and newly appointed managers are: Northeastern, **R. E. Belknap, Jr.,** New York; Southeastern, **D. L. Nivling,** Philadelphia; Great Lakes, **R. F. Tighe,** Cleveland; North Central, **S. G. Wagner,** Chicago; South Central, **T. J. Gerber, Kansas City;** and Western, **R. H. Gannon,** Los Angeles.

★ ★ ★

The regional managers are responsible for planning and directing all sales operations within their areas, including the overall management of district and branch offices.

To Supervise Crucible's Stainless Research

Crucible Steel Company of America has announced the appointment of **Dr. John H. Hoke** as Supervisor of the Stainless Steels Section of the Company's Central Research Laboratory in Pittsburgh.

★ ★ ★

In his capacity Dr. Hoke will direct continued development of the laboratory's stainless steels program. Particular emphasis in the program will be placed upon development of new grades and improvement of present ones for tonnage applications and use under climatic conditions.

Named Chief Chemist by Sheet & Tube

Ernest W. Polley has been appointed chief chemist for the Youngstown District of the **Youngstown Sheet and Tube Company,** District Manager **J. S. Stanier** has announced. He has been assistant chief chemist since September, 1947, and succeeds the late **L. C. Flickinger.**

★ ★ ★

The appointee received his B.S. degree in Chemical Engineering from Carnegie Institute of Technology, and joined The Youngstown Sheet and Tube Company at the age of 18, working as an analyst in the Coke Plant laboratory between his high school and college days. He then served as a chemist in the Brier Hill Chemical Laboratory and became general foreman of that laboratory in 1929.

Keystone Advances Two Men

Appointment of **L. B. Lindemuth, Jr.,** as Open Hearth Superintendent of the **Keystone Steel & Wire Company** has been announced by **A. H. Sommer,** Vice President and General Superintendent.

★ ★ ★

At the same time **A. R. Edwards,** Open Hearth Superintendent since 1950, was made Administrative and Technical Advisor.

Mr. Lindemuth came to Keystone in May, 1955, as process control engineer, a position held until his present appointment. A graduate of Cornell University, he was staff assistant to the Open Hearth Superintendent at Wisconsin Steel Company of Chicago prior to joining Keystone.

★ ★ ★

Mr. Edwards started with Keystone after attending Hedding College, in 1919, in the Open Hearth Department. He was made melter foreman in 1926 and Open Hearth Superintendent in 1950.

Edward J. Byrnes, Jr.

Edward J. Byrnes, Jr., Assistant General Manager of Sales,

NORBIDE* Abrasive Grain...

Ready to cut Your Refinishing Costs!

Wire men who have switched from costly diamond dust to NORBIDE Abrasive for refinishing dies are amazed at the savings. They have found NORBIDE Abrasive — the hardest manufactured abrasive commercially available—ideal for ripping and semi-finishing operations. Whatever your requirements, we can supply you promptly from stock.

For details and prices on this cost-cutting abrasive, write for form 559, NORTON COMPANY, 45 New Bond St., Worcester 6, Mass.

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Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories.
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*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

NORBIDE* *The hardest manufactured abrasive commercially available!*

Eastern Division of **The Colorado Fuel and Iron Corporation,** died Wednesday, October 8, at the Palmer Spring plant of CF&I in Palmer, Mass.

★ ★ ★

Mr. Byrnes started his career in 1925 as an administrative assistant in the Springs and Formed Wire Department of the Wickwire Spencer Steel Company, which later merged with CF&I. He later became Assistant Product Manager and then Product Sales Manager of the Springs and Formed Wire Department.

Stelco Wire Division Sales Appointment

C. P. Short, General Sales Manager, Finishing Mill Products, **The Steel Company of Canada, Limited,** has announced the appointment of **W. K. Newcomb** to the position of Sales Manager, Manufacturers Wire, Eastern Division.

★ ★ ★

Mr. Newcomb attended Trinity College School, Port Hope, and McGill University, Montreal, where he received his B.A. He joined Stelco in December, 1950 as a Sales Trainee. In August, 1953 he entered the Wire Sales Division and became senior assistant to the Sales Manager, Wire and Wire Products, Eastern Division, the following year serving in that position until his recent appointment.

W. K. Newcomb

Made Branch Manager by Bakelite

The appointment of **F. W. Wurtzell** as Central Zone Manager for the Extrusion Materials Division is announced by **Bakelite Company, Division of Union Carbide Corp.**

★ ★ ★

With headquarters in Chicago, Mr. Wurtzell will be in charge of Extrusion Materials technical representatives responsible for sales and customer service of Bakelite extrusion materials, including polyethylene, vinyl, polystyrene and fluorothene extrusion resins. District sales offices comprising the Central Zone are in Chicago, Detroit, Cleveland and Cincinnati.

★ ★ ★

He graduated from the University of Illinois in 1942 with a B.S. degree in Chemical Engineering, joining Bakelite the same year in the Company's Development Laboratories until 1946, when he joined the Sales Department in the New York area. Since 1948, he has been in the Chicago office.

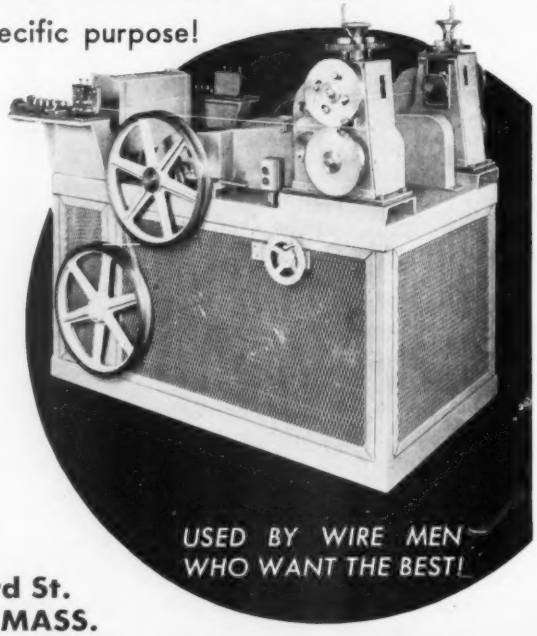
Sjogren

STRAIGHTEN and CUT-OFF for OIL TEMPERED BRUSH WIRE

Another specially designed machine for a specific purpose!

Wire mills furnishing oil tempered flat wire in cut lengths to the brush manufacturing trade will find an increased production rate with the use of a Sjogren specially designed straighten and cut-off machine — which will accommodate .020" x .060" to .025" x .090" sizes. Fast and accurate cuttings may be made; if desired, two different lengths and two different sizes of wire may be processed at one time — since the machine is equipped with two units, each with its own motor and controls. Typical production has shown that 500 pieces, 5" long per minute are available from each unit.

Cut-off lengths may range from 5" to 26" — which covers the majority of flat wire brush requirements.



Sjogren TOOL & MACHINE CO., INC.

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A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50c for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,803,412, APPARATUS FOR REELING WIRE, patented August 20, 1957 by Alphonsus J. Waslov, Gloucester, N. J., assignor, by mesne assignments, to Charles P. Boyd, Devon, Pa.

Included is a wire shifting device mounted for swinging movement in a plane generally parallel to the axis of the reel and rockable for automatically shifting the wire alternately in opposite directions axially of said reel at predetermined intervals while the wire is continuously wound in opposite directions in successive layers across the face of the reel. Specific means is provided for the actuation of the shifting device.

★ ★ ★

No. 2,804,196, DEVICE FOR DESCALING AND CLEANING WIRE ROD, patented August 27, 1957 by Earl C. Planett, San Marino, California.

The descaling device is magnetically operated and adapted to receive the lubricated and drawn wire.

★ ★ ★

No. 2,804,227, WIRE CONTAINER STRUCTURE, patented August 27, 1957 by Ernest T. Elfgren, Killingly, Connecticut.

There are fourteen claims to this structure which is composed of wire sections and includes a specially constructed closure.

★ ★ ★

No. 2,804,235, FEEDER FOR SCREW SLOTTING MACHINE, patented August 27, 1957 by Emil Roy, Windsor, Connecticut.

A feeder is provided to detect an oversize blank and stop the operation of a carrier member, before the blank reaches the blank clamp for slotting operations.

★ ★ ★

No. 2,804,404, METHOD OF IMPREGNATING ELECTRICAL WINDINGS, patented August 27, 1957 by Elmer E. Thiessen, La Grange, Ill., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware.

The method includes immersing the windings in a bath of varnish thinned with a solvent containing a substantial portion of high boiling constituent and a substantial portion of low boiling constituent while the winding is uniformly heated to a temperature at least higher than the boiling point of the low boiling constituent, allowing the winding to remain in the bath until the winding is impregnated with the varnish and until a substantial proportion of the low boiling constituent is volatilized by the intrinsic heat energy of said winding.

★ ★ ★

No. 2,805,179, ELECTRIC CABLE, patented September 3, 1957 by Harvey Burr, Liverpool, England, assignor to British Insulated Callender's Cables Limited, London, England, a British company.

More specifically, the invention relates to apparatus for applying a flat thermoplastic strip about a longitudinally advancing wire as an open-turn helical fin, in contact with and extending radially from the wire. There are twelve claims.

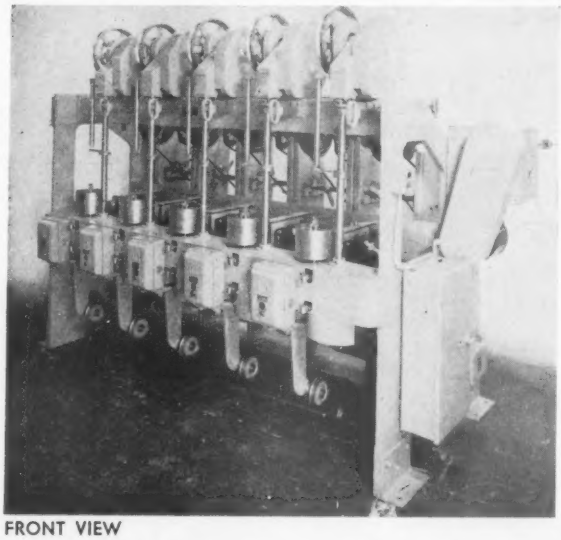
★ ★ ★

No. 2,805,180, ELECTRIC CABLE, patented September 3, 1957 by Harvey Burr, Liverpool, England, assignor to British Insulated Callender's Cables Limited, London, England, a British company.

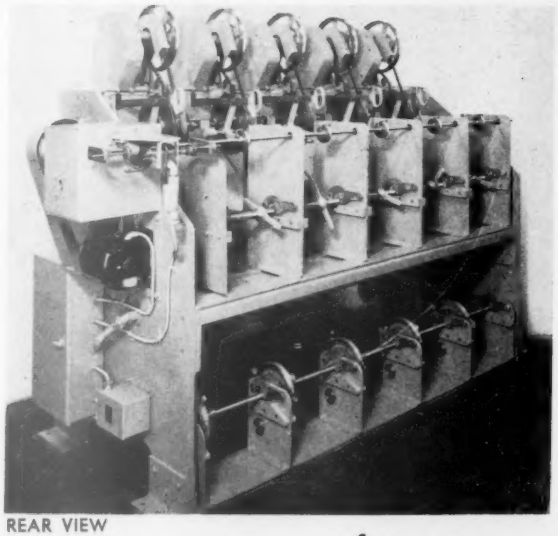
This is a modification of the apparatus of Patent 2,805,179. There are four claims.

★ ★ ★

No. 2,805,471, METHOD FOR LOCATING PATHS OF WIRES ON LACING BOARD, patented September 10, 1957 by Gordon A. Lowden, Miamisburg, Ohio, assignor to The



FRONT VIEW



REAR VIEW

#2S-5-MBB INSULATION WINDING MACHINE

APPLIES SINGLE COVER TO 5 LINES OF WIRE SIMULTANEOUSLY. NOMINAL WIRE RANGE #15 TO #25 B & S GAUGES (.057" TO .018" OR 1.450 TO .455MM). STANDARD CAPSTANS 8" DIAMETER, BUT MACHINE ILLUSTRATED IS SPECIALLY ARRANGED WITH 12" DIAMETER CAPSTANS, IN PLACE OF STANDARD 8", FOR HEAVIER WIRES. SUPPLY WIRE LET-OFFS AND TAKE-UPS ARE AT REAR OF MACHINE.

EST. 1855 AIMCO INC. 1915

"American" AIM INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

FAIRHILL AND HUNTINGDON STREETS

PHILADELPHIA 33 PENNSYLVANIA U.S.A.

National Cash Register Company, Dayton, Ohio, a corporation of Maryland.

A method is disclosed of forming a wiring harness having a tortuous configuration to conform to the outline of a machine with which it is to be associated, and to the positions of electrical terminals to be connected on the machine.

★ ★ ★

No. 2,805,472, METHOD FOR PRODUCING INSULATED COILS AND PRODUCTS THEREOF, patented September 10, 1957 by John C. Botts, Pittsburgh, Pa., and Jack E. Northwood, Dunkirk, Ind., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania.

The method is to the preparation of a multiconductor coil having a slot portion and end portions extending from each end of the slot portion.

★ ★ ★

No. 2,805,538, METHODS OF AND APPARATUS FOR MAKING ELECTRICAL CONDUCTORS, patented September 10, 1957 by Hubert L. Wessel, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

There are sixteen claims to this patent, including claims to the apparatus which comprises devices for advancing a core longitudinally at a constant speed and rotating it about its longitudinal axis, a device for directing a strand of material to the core so that the rotation and longitudinal advancement of the core cause the strand to be wrapped helically therearound, a takeup device for winding the strand-encircled core upon a spool, and a device for loosening the strand around the core as the strand-encircled core is being wound upon the takeup spool.

★ ★ ★

No. 2,805,806, BICYCLE BASKET, patented September 10, 1957 by Clarence S. Glenny, Rockford, Ill., assignor to The Washburn Company, Worcester, Mass., a corporation of Massachusetts.

The basket is of wire and metal clips and bolts. There are eight claims.

★ ★ ★

No. 2,806,507, SPRING WINDING MACHINE, patented September 17, 1957 by Charles J. Stofko, Bristol, Conn., assignor to Associated Spring Corporation, Bristol, Conn., a corporation of Delaware.

This machine is said to be fully automatic and adapted for winding helical torsion springs. Special means is provided for positioning an empty spindle to receive the end of a length of wire at the beginning of the spring-winding operation.

★ ★ ★

No. 2,807,425, COIL WINDING APPARATUS, patented September 24, 1957 by Henry J. Kent, West Englewood, N. J., assignor to Kearfoot Company, Inc., Little Falls, N. J., a corporation of New York.

There are fifteen claims to this patent for a winding machine for winding magnetizing coils directly on annular magnetizable stator core structures provided with coil receiving slots.

Three Machining Aids Offered by Kaiser

Three informative aids for screw machine operators, shop management and metals buyers are now available from **Kaiser Aluminum & Chemical Sales, Inc.** They include a guide for machine feeds and speeds, a quantity-weight slide rule calculator and a manual of basic information on machining aluminum.

★ ★ ★

All three can be obtained free from Kaiser Aluminum & Chemical Sales, Inc., Box SMS, 919 N. Michigan Ave., Chicago 11, Ill.

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reading regularly
WIRE AND WIRE PRODUCTS
The Wire Man's Magazine

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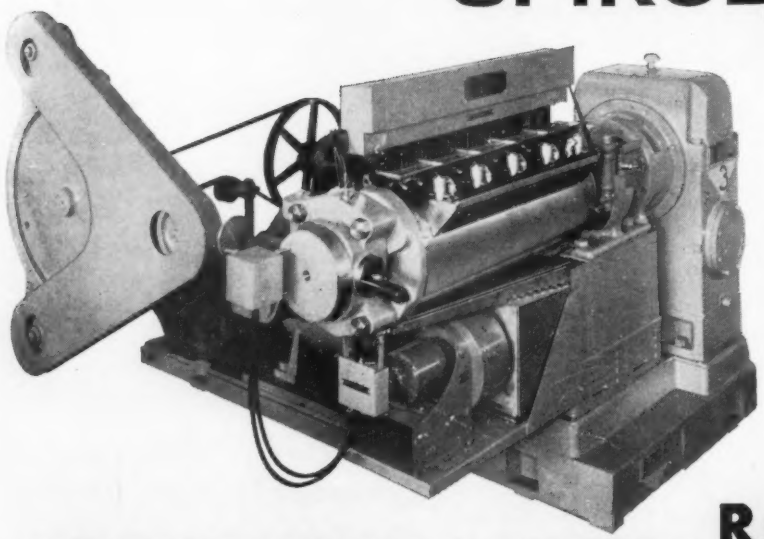
for Rubber or Plastic Wire Insulating



These all electric extruders with radiant heat and high velocity evaporative cooling are designed to process either plastic or rubber compounds. The result of more than three quarters of a century of experience — Royle pioneered the extrusion process in 1880— in the design and construction of extruding machines time tested features have been built into Spirod to assure dependability.

Write for Bulletin #463

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H. M. Royal, Inc.
LUdlow 9-3261

Tokyo, Japan
Okura Trading Co., Ltd.
(56) 2130 - 2149

Standardization of Torque Values For Stiffness Testing of Wires Used As Grid Siderods in Radio Tubes

(*Continued from page* 1364)

Summary

Tests conducted to date can be summarized as follows:

1. **Different materials require different torque values.**
2. **Torque values at constant bend angles and degrees bend at constant torque, show a high degree of correlation with yield strength.**
3. **The work hardening rate expressed in torque values follows the power law within defined areas.**
4. **The effect of diameter on angle of bend is negligible within standard size tolerances.**
5. **Cold work due to stretching does not alter the linear relationship between yield strength and angle of bend.**
6. **Torque vs. diameter follows the power law.**

★ ★ ★

It is hoped that this work will create further interest on the stiffness testing of wires used throughout the electronics industry and thereby result in more realistic torque values. Standardization of torque values should be relatively easy once these studies are correlated between the different groups.

Electric Furnace Company Building Research Center

The Electric Furnace Co., Salem, Ohio, has announced that it is in the process of constructing a new building to house its Research and Experimental Department, the activities of which will be under **R. J. Perrine**, EF's Director of Research.

★ ★ ★

The building will be located adjacent to the company's plant, where projects relating to research and development leading to better processing and improved metallurgical developments will be undertaken.

★ ★ ★

While the facilities will be used primarily for research and development initiated by the company, the work will also include special services for customers in the solution of their heat-treating and related problems.

Dropping Production of Magnet Wire

E. F. Lazar, vice president and general manager, of the **Wheeler Insulated Wire Co.**, Waterbury, Conn., has announced that in order to provide for further expansion of the company's major activity in transformers, coils, wiring harnesses, electronic chassis assemblies, sound powered electric telephones and other electronic products, it will discontinue the manufacture of all types of enameled and yarn insulated magnet wire.

★ ★ ★

This subsidiary of **Sperry Rand Corporation** expects to complete present production on magnet wire in September.

SEE THE DIFFERENCE YOURSELF...
BETWEEN JUST ANY SPOOL AND
Superior MPS
NO-CREV SPOOLS
No-Crev Spools eliminate the conventional crevice at the inner junction of spool head and barrel. No more production slow-ups due to fine wires getting caught in such a crevice. You can now have continuous trouble-free high speed winding.
We invite your inquiries — let us tell you more about No-Crev Spools. Write us today.
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give you brute strength with dimensional precision, concentricity, and balance. Another patented MPS development engineered to help you!
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Telephone Attleboro 1-0848
#108

Aluminum for Fastener Production

(*Continued from page* 1358)

cal of these shear cracks as opposed to a straight crack that follows seams acting as stress raisers. These shear cracks were the result of excessive cold work for the alloy and temper applied.

★ ★ ★

The screws in Figure V illustrate defects occasionally found in threaded fasteners. This defect was initiated by alternately changing the axis lengths of the section without elongation. Improperly aligned roll threading dies could produce this defect, but the most common cause is roll threading a shank diameter too large for the finish thread diameter.

★ ★ ★

Solution heat treatment of the hard alloy rivets is usually a batch-type operation. The rivets are placed in perforated baskets, loaded in air atmosphere furnaces equipped with controls for a plus or minus 5°F maximum temperature variation. Exceeding the solution heat treat temperature recommended in Table IV may result in eutectic melting, commonly referred to as "burning." Eutectic melting may, though not always, manifest itself by blisters and/or cracks on the surface of parts. Accurate temperature controls on furnaces used to solution heat treat aluminum are essential to avoid the scrapping of fabricated fasteners. Time at temperature must be allowed for the soluble constituents to go into solution. The rivets are quenched by **pouring** rivets into cold water **immediately** after removal from furnace. From 12 to 15 seconds is normally the maximum time suggested between removal from furnace and quenching. Poor quenching results in lowered mechanical properties and lowered corrosion resistance. Table IV presents solution heat treatment cycles. Alloys 2017, 2117, and 2024 age harden (precipitation hardening) at room temperature. These alloys reach maximum properties within 4 days after quenching. Alloys 6053, 6061, and 7075 age harden very slowly

TABLE IV

RECOMMENDED HEAT TREATMENT

	Solution Heat Treatment (1)		Precipitation Heat Treatment		
Alloy	Metal Temp. °F	Resulting Temper	Metal Temperature °F	Soaking Time-Hrs.	Resulting Temper
2017	925 - 950	2017-T4			
2117	890 - 950	2117-T4			
2024	910 - 930	2024-T4			
6053	960 - 980	6053-T4	340	10	6053-T6
6061	960 - 1010	6061-T4	340-360	6-10	6061-T6
7075	860 - 930	7075-W (2)	240-260	24	7075-T6

(1) Solution heat treatment time depends on type of furnace and size of load. Time for fasteners should be 20 minutes to one hour at temperature.

(2) The "W", usually followed by a time as "W(3 days)", designates the unstable condition of as-quenched 7075 alloy.

NEW WINSTROM

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Model ESS-2

- SENSITIVE ELECTRONIC RELAY DESIGNED SPECIFICALLY FOR EASE OF INSTALLATION, NO MAINTENANCE, SUPERB RELIABILITY AND PACKAGED TO WITHSTAND THE HARDEST SERVICE TO WHICH COMPETITIVE INDUSTRIES CAN EXPOSE IT.
- TWELVE MODELS AVAILABLE TO MEET YOUR MOST EXACTING REQUIREMENTS.
- IDEALLY SUITED FOR USE ON CLUTCH-TYPE COILERS FOR TRIGGERING ELECTRIC CUT-OFF MECHANISM, INSULATION TESTING, DROP WIRE DETECTION, LIQUID LEVEL CONTROLS, SAFETY DEVICES AND HUMAN TOUCH CONTROL OF ELECTRONIC DEVICES.
- SEND FOR BULLETIN ESS-2, WHICH GIVES FULL DETAILS, INCLUDING RELAY COMBINATIONS, SENSITIVITIES, PRICES AND DELIVERY.

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at room temperature and for maximum properties are subjected to artificial aging at elevated temperatures.

★ ★ ★

Fasteners solution heat treated at too low a temperature may be salvaged by reheat treatment at the proper temperature. Fasteners receiving a poor quench may also be reheat treated, but the reheat treat temperature should be slightly higher than the initial temperature to avoid impairing the corrosion resistance. Eutectic melting cannot be corrected by reheat treatment and the parts should be scrapped.

★ ★ ★

Finishes on fasteners vary with end-use requirements. Finishes may be acquired by mechanically polishing or chemical treatments. Tumbling aluminum parts with pumice or vegetable fibers (coconut or corn husks, etc.) produces a fairly uniform surface. Chemical bright dips can be used to produce a high lustre. Anodizing or Alrok coating builds up a protective aluminum oxide coating which is very hard and wear and corrosion resistant.

★ ★ ★

Millions of pounds of aluminum rod are fabricated into aluminum fasteners annually. The comparative ease by which aluminum is fabricated needs only be supplemented by good handling procedures in storage areas, and while being fabricated on machines, to produce quality aluminum fasteners.

References

1. "Cold Working of Metals", AMS, 1949.
2. "Forging and Forming of Metals", S. E. Rusinoff, ATS, 1952.
3. "Recommended Standards for Wrought Aluminum Mill Products", The Aluminum Association.
4. Government Specifications:
   MIL-W-7986—Wire & Rod, Aluminum & Aluminum Alloys For Die Heading.
   MIL-H-6088A (ASG)—Heat Treatment of Aluminum Alloys; Process For (Aircraft Application).
   MIL-R-1150a-1—Rivets, Solid (Aluminum Alloys), And Aluminum Alloy Rivet Wire and Rod.
5. "Materials and Methods", July, 1949, Page 72.
6. "Materials and Methods", November, 1951, Page 85.

Folder Describes Self Locking Screw

The principles and advantages of Spin-Lock Screws are detailed in a new four-page bulletin published by **Pittsburgh Screw and Bolt Corporation.** Designed to replace separate screws and washers, these one-piece fasteners feature a ratchet-like element which grips the work securely.

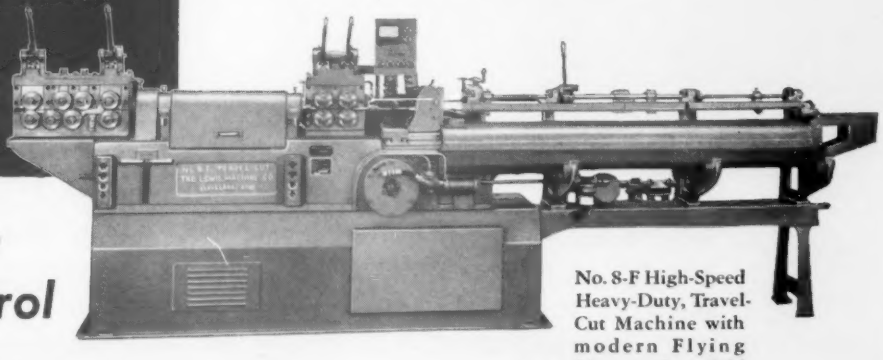
★ ★ ★

Copies of the bulletin may be obtained from Pittsburgh Screw and Bolt Corporation, Pittsburgh 30, Pa.

WIRE STRAIGHTENING AND CUTTING with Air Clutch and Air Brake

for better quality control

• Greater accuracy with a minimum of spot swell is achieved through three important improvements on the famous Lewis Travel-Cut Wire Straightening and Cutting Machines . . . Wichita Air Clutch and Brake and Reeves Variable Speed Drive. There are 34 models in the Lewis line from .012" to ¾" rounds and shapes at speeds up to 200 FPM. Write for new brochure.



No. 8-F High-Speed Heavy-Duty, Travel-Cut Machine with modern Flying Shear Cut-Off Mechanism. Handles 5/32" to 3/8" dia. wire at speeds up to 200 FPM.

THE LEWIS MACHINE COMPANY

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Licensees of Heli-Coil Thread System to Meet in Paris

World-wide licensees and agents of the **Heli-Coil Corp.**, Danbury, Conn., a Division of Topp Industries, met in September in Paris,, France, for an international Convention to exchange technical and application data and marketing techniques.

★ ★ ★

Organized by Resources & Facilities Corporation, New York, foreign licensing agent for Heli-Coil, the Convention highlighted the unique position that Heli-Coil wire thread inserts have achieved in standardizing an international system of screw thread fastenings. Many countries differ substantially among themselves in the screw thread standards they follow.

★ ★ ★

Attending from the U.S. were **Eduard Baruch,** President of Heli-Coil, **Eugene M. Lang,** President of Resources & Facilities Corp., and **Leo Brancato,** Vice-President and Director of Engineering of Heli-Coil.

★ ★ ★

Following the Convention, Messrs. Baruch, Brancato and Lang visited Heli-Coil manufacturing facilities and many industrial plants in France, Germany, Italy and England.

New Powerhouse For Aluminum in Canada

A huge underground powerhouse, capable of generating a million horsepower of electricity, is under construction by Aluminium Limited at Chute-des-Passes, Quebec, over 300 miles north of Quebec City. It will cost over $125,000,000.

★ ★ ★

The project involves digging a six-mile tunnel twice the width of New York's Holland tunnel to the powerhouse. Here the company will install five 200,000 horsepower generators, largest of their kind in the world, capable of producing one million horsepower of electricity. When completed, Chute-des-Passes power facilities will give Aluminium Limited a total of 4,780,000 horsepower of electricity in Canada.

★ ★ ★

The project is a part of Aluminium Limited's Canadian aluminum producing facilities. More than 15% of all primary aluminum used in the United States comes from Canada.

Heat Treat Review

New issue features story describing and illustrating facilities of one of the West's leading commercial heat treating companies. The most modern design in controlled atmosphere equipment is used to process an endless variety of metal parts.

★ ★ ★

Another article illustrates the use of make-up air with gas-fired line burners for dust-free conditioning of critical assembly areas.

★ ★ ★

Request copy of Heat Treat Re-

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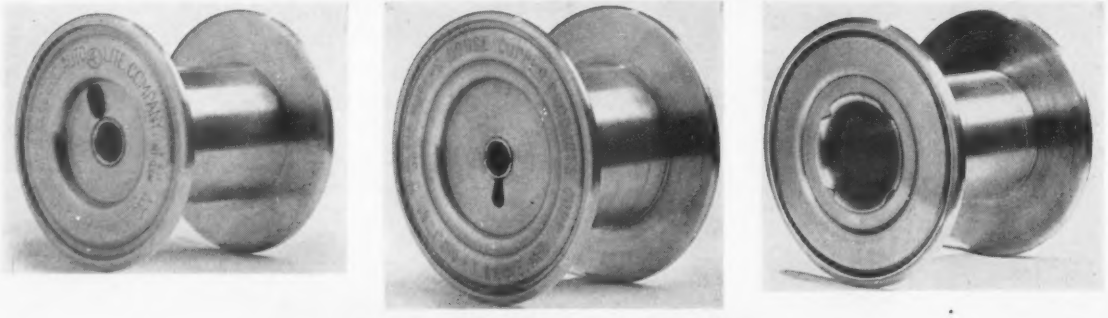

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Check with HUBBARD for your spool needs.

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view, Volume 8, No. 2 from **Surface Combustion Corporation,** Toledo 1, Ohio.

★ ★ ★

For additional information. Contact: Quinten Kenny, Publicity Manager, Surface Combustion Corporation, 2375 Dorr Street, Toledo 1, Ohio.

New Aluminum Power Cable Developed

A new high-strength, low-cost all aluminum conductor now is available for use in overhead electric power lines, a development of **Reynolds Metals Company.**

★ ★ ★

Called 5005 Alloy Conductor, the new cable is lighter in weight than copper or ACSR. It is as low in cost as ACSR and stronger than standard EC cable.

Endeavors to Stabilize Aluminum Wire Market

The Southwire Co., Carrollton, Ga., one of the larger producers of aluminum wire, has moved to stabilize a wire market riddled by price cutting.

★ ★ ★

The firm, a non-integrated wire mill with annual capacity of about 50,000,000 pounds, announced it is cutting reinforcing aluminum wire three cents a pound and its insulated wire from 15 to 20 per cent.

★ ★ ★

Trade sources commented that the new Southwire prices, however, still are above those being quoted by other interests. **Roger J. Schoerner,** vice-president of Southwire, commented that an "unrealistic" price policy has been in effect throughout the industry and some companies have been quoting different prices to different customers.

★ ★ ★

The industry is not too optimistic about Southwire's efforts to stabilize prices at a profitable level. Producers of aluminum wire, which in many cases has been replacing copper in electric transmission lines, have been complaining about lack of profit on this tonnage item.

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WIRE AND WIRE PRODUCTS circulation is all paid. We have no agents, offer no premiums or make special inducements to get circulation, except the value of the editorial contents in itself—yet our renewals have averaged 97% or better for many years. That's why it is a good and forceful advertising medium for all concerns who have products to sell to the wire industry.

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Accurate, Efficient, Non-destructive Fault Detection at Production Rates to 4000 fpm and higher

Designed to meet the increasingly rigid inspection standards of wire manufacturers and users, PESCHEL Model 10-CVX High Voltage DC Insulation Tester is ideal for use with extruders, vulcanizers or twinners. May be used to replace AC sparkers where 0-10KV DC is ample (20KV models also available).

Detection, indication and recording of every fault is assured, without burning or marking insulation. Safe and easy operation by unskilled personnel. "Zero-length" electrodes (1" and shorter!) conserve floor space, particularly in HV test applications.

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UNLIKE SOME TOOLS

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CUTTING NIPPERS

don't have 1000 uses. They are made only for cutting wire.

CAREW NIPPERS will continue to do this year after year; cutting efficiently long after most tools have been junked.

MADE IN 4 SIZES

8", 10", 12", 14"

Jaws are made of hardened tool steel and are removable for sharpening.

STOCKED BY MOST MILL SUPPLY DEALERS

Made by

M. W. ROBINSON COMPANY

ROCKFALL, CONNECTICUT

The All-Metal Reel— For Modern Cable Packaging

(*Continued from page* 1360)

ordinary variety—and some adjustment might seem to be required in the case of reels of the metal bound type. In this case, relating only to reels in the smaller sizes, from 42" to possibly 60", it appears safe to indicate a service life ratio of at least 2½ to 1 for steel versus these reels—and, by cost and weight comparisons, the steel reels should here save from 10% to 27%.

★ ★ ★

The further step remaining for comparison of costs, as between the use of wood or steel reels, will have to do with the factor of maintenance and repairs.

★ ★ ★

As taken from a user's detailed report of maintenance experience with Toroidal steel reels in sizes ranging from 50" to 78" during a period of 4 years and 9 months, it was established that in the use of over 36,000 reels, throughout the time indicated, the maintenance and repair expense amounted to less than 20 man minutes per reel trip—and this included painting and stenciling—also special mechanical repairs for 200 damaged reels.

★ ★ ★

Data furnished by one of the largest users of wood reels discloses—by a breakdown of costs—that the maintenance and repair expense of wood reels has averaged about $4 per reel per trip. This provides a sufficient comparison against the above experience with Toroidal reels to warrant the expectation that the proper maintenance of the steel reels should amount to no more than 50% of the same servicing of wood reels.

★ ★ ★

To further minimize the cost of any repairs that may be required for steel reels, there is available a special fixture with related tools for this purpose—as has been demonstrated to representatives of 20 cable producers during two meet-

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BLEEDER STOCK CABLE STRIPPINGS AND CUTTINGS— Reprocessed To Original Extrudability

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for extra tonnage
from your bar stock
and wire dies

coat with
BORAX 5 MOL.

Borax and Borax 5 Mol
Offer Many Advantages as a
Coating Material

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ings at Princeton University.

* * *

Since the foregoing comparisons have been confined to the cost of using reels made from wood, or the Toroidal type made from steel, this might raise a natural question concerning the substitution of aluminum for steel in this all-metal reel.

* * *

On this score it can be said that several thousand Toroidal reels have been so produced—for experimentation. Only it is too early to appraise results from tested performance. It has been fairly well determined that these reels would cost about twice as much but—while they would weigh only half as much—it is not known as yet what their service life might be.

* * *

Now, most of this may have seemed merely a special effort to promote an interest in just one particular steel product—as being the most modern of all metal reels for cable packaging.

* * *

Returning, however, to the former thought that, after all, demand is the best gauge for judging what is modern, it may here be noted that Toroidal steel reels have been adopted by numerous large segments of the industry.

* * *

For a direct expression of views reflecting their experience with these reels, two of the largest users were invited to furnish comments that might be of interest for inclusion in this paper.

* * *

Each of these companies has been engaged for some time in a program of conversion from wood reels to Toroidal reels—and, quoting exactly from their responsive reports, here is what they have to say about them:

COMPANY "A" REPORTS:

"Our program for the use of shipping reels for electrical cable contemplates the replacement of all returnable wood reels—size 48 and larger, with steel reels of the same type as now being furnished by the George Evans Corporation.

CUT
Die Room
COSTS
50%
with the New
type "M"

DYKREX
"IT CORRECTS THE DIE"

automatic
Polishing Machine

Double your finished Tungsten Carbide Die production

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Save ½ labor costs—

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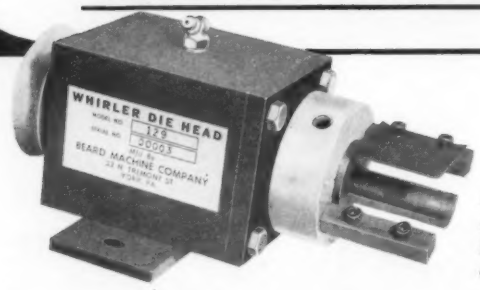
The Standard of the Wire Industry

CUT COSTS OF APPLYING ASBESTOS INSULATION



Beard Whirler Die Head model No. 129 with 9/16" die holder... 3/8" and 1/4" holders also available.

NEW BEARD WHIRLER DIE HEAD AND DIES HANDLE OVER 100 DIFFERENT WIRE SIZES. IMMEDIATELY AVAILABLE!

Want uniform wire insulation of highest dependability... at lowest possible cost? Use modern Beard Whirler Heads and Dies in your asbestos insulating system. Beard dies are immediately available to accommodate more than 100 wire sizes. Can be used as wet whirlers and polishing heads, too. If you want flexibility, simplicity of operation, and big savings of time and labor — write for detailed data sheets and full information NOW!

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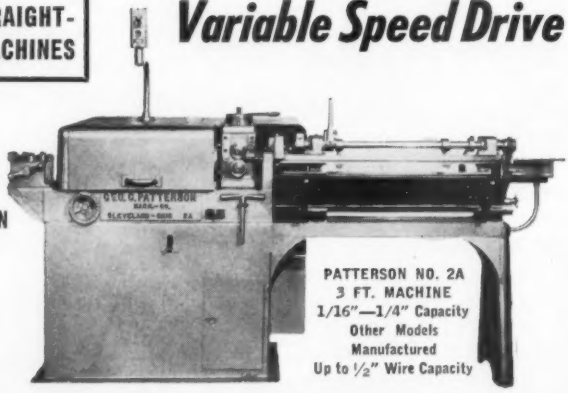
AUTOMATIC WIRE STRAIGHTENING & CUT-OFF MACHINES

Electrically Operated with Variable Speed Drive

- MINIMUM COST
- MAXIMUM PRODUCTION
- ACCURATE LENGTHS
- NEW FEATURES



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3409 TRUMBULL STREET
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PHONE: BROADWAY 1-1808

"Cost studies have been made and our decision is that savings will result in both shipping costs due to lighter weights and in reel replacement due to longer reel life. Furthermore, it has been our experience that we have found greater customer acceptance of steel reels and in some cases, our customers have insisted that cables be shipped on steel reels.

"It is our opinion as well as that of our customers, that the use of steel reels will reduce possible damage to electrical cables, both in shipment and in storage."

COMPANY "B" REPORTS:

"1. After careful analysis we concluded that in the long run, the toroidal steel reel would be less costly for us than the wood-metal or structural steel reels because:

a. The greater number of trips which can be obtained from the toroidal reel compared to a wood-metal.

b. The freight savings resulting from the fact that size for size the toroidal is lighter than the wood-metal or structural reel;

c. The lower maintenance and repair costs of the toroidal as compared to the other types; and

d. The fact that the toroidal reel, because of its design is far less susceptible to the type of damage and flange deformation which caused cable damage, particularly in the case of lead covered material.

"2. Our experience over the two years that toroidals have been in general service in our company indicates that our original estimates of savings were conservative:

a. Damage, and consequently maintenance and repair costs, have been materially less than anticipated;

b. Freight savings are greater because of the freight rate increases which have occurred; and

c. It appears that the toroidal reel may have a longer period of usefulness than originally estimated."

The two companies submitting these reports are presently employing about 15,000 Toroidal steel reels. In one case many of these have been in use since 1949—in the other since 1953.

You Are Invited To Join
THE WIRE ASSOCIATION
Send for booklet describing its activities and a membership application card.
453 Main St. Stamford, Conn.

Plated Wire from the Consumers' Standpoint

(*Continued from page* 1355)

trained technician using a metallurgical microscope. Magnification of approximately 350 times is used. By means of a calibrated eye piece on the microscope, accurate thicknesses of plating can be determined. Report of results are issued to Engineering and record kept for evaluation and comparison.

Humidity Resistance

Representative samples of production plated wire parts are periodically subjected to humidity resistance in a standard test room incorporating high temperature and high humidity conditions. By this means a check can be maintained particularly on the protection of the weld areas afforded by the clear coat of baking enamel.

Salt Spray Resistance

In some cases plated wire parts are subjected to Salt Fog test in accordance with the procedure outlined under ASTM Designation B117. Although such tests are sometimes erratic, parts produced by different suppliers may be compared and evaluated when tested simultaneously.

Abrasion Resistance

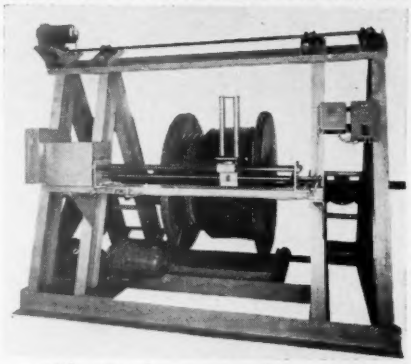
Plated wire parts such as Refrigerator Shelves and Oven Racks must withstand considerable abrasion during normal use in the home. Testing for this abrasion resistance is accomplished by means of a machine which automatically slides a glass beaker, loaded with specific weight, back and forth over the wires. This machine operates at 12 cycles per minute and incorporates an automatic counter. Observations are made periodically to determine the rate of wear on the finish.

★ ★ ★

These tests as stated before are conducted by the Laboratories in our production plants, however equivalent tests on production parts are also run at various times in our Engineering Laboratory to

LARGE REEL TAKE-UP

FOR USE WITH OUR LARGE FOUR-WIRE TWISTING MACHINES OR PLANETARY CABLERS



Made in sizes to accommodate reels up to 84 inches in diameter.

It is an arborless type. The driving shaft is hollow, with an extensible solid shaft that centralizes the reel and drives it. The idle shaft is moveable back and forth by means of a gear and rack, controlled by a hand wheel.

The reel to be loaded is placed on the loading platform, rolling in machined ways and is pushed onto the driving shaft by the idle shaft and hand wheel.

The reel is lifted to the operating position by four motor driven enclosed lifting screws, equipped with limit switches.

The traverse mechanism is a single screw, reversed by Warner Clutches and having its rate of lay controlled by change gears. It can be positioned and moved by hand.

The reel is driven by a Louis Allis Adjusto Spede Drive coupled to a four speed Drive-All Unit, to give constant tension on the cable being taken up.

Write for further information.

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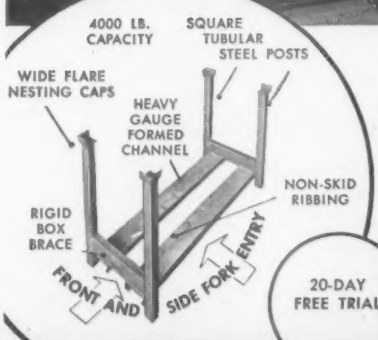
PORTABLE
WIRE COIL RACKS

COURTESY HOLO-KROME SCREW CORP.



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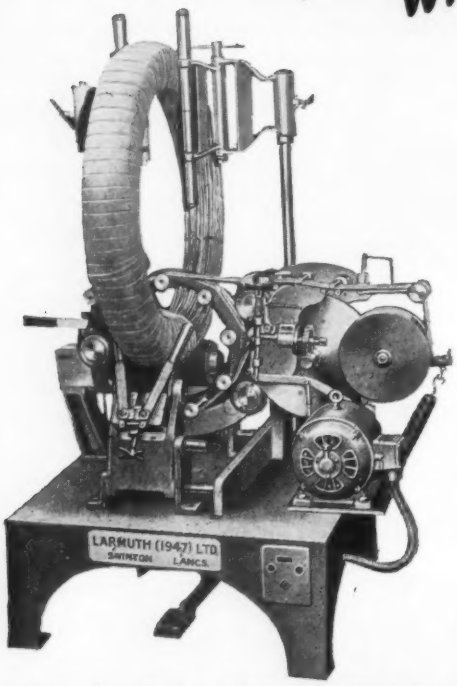

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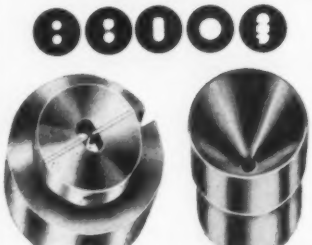
for EXTRA-HIGH ELECTRIC WIRE PRODUCTION



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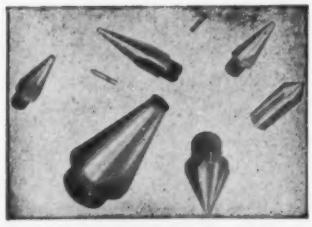
Highest Quality Workmanship and Materials. Standard Types and Special.



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BRIDGEPORT CARBIDE NOZZLES have phenomenally long life, will lower operating costs and reduce wire breakage.

BRIDGEPORT STEEL DIES are made in Round, Figure 8, Serrated, Tracer and other Special Shapes to your specifications. A newly designed Tru-Rip Die Assembly can be taken apart, cleaned, blades changed and reassembled quickly and easily. Made for 2 and 3 conductor wires to be coated in extrusion machines.

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LEADER IN HIGH PRODUCTION EXTRUSION TOOLS FOR ELECTRIC WIRE

permit direct comparison with, and evaluation of, experimental methods and materials for possible future production use.

★ ★ ★

In my discussion I have pointed out some of the major applications of plated steel wire in the appliance field and I have described in some detail the requirements to be met by the plating. It is therefore, most appropriate to leave you with the challenge to work toward improvement in corrosion resistance through any channels that may be available to you. If this can be done so as to maintain good eye appeal under conditions encountered by present day appliances, it will mean more business for you and less trouble for the appliance industry.

★ ★ ★

I wish to again thank you for the privilege of representing the appliance industry at this convention. May I also wish your organization continued success in its future endeavors.

Cotsworth Named Staff Manager for Stainless Steel by Chase

Appointment of **John L. Cotsworth** to the position of staff manager—stainless steel for **Chase Brass & Copper Co.** was announced in September by **George B. Moseley,** vice president—sales. His headquarters will be at the Waterbury office.

★ ★ ★

He is a graduate of Rensselaer Polytechnic Institute, with a B.S. degree in Chemical Engineering, and comes to Chase with an impressive background of 20 years of specialized experience in stainless steel, which encompasses commercial, technical and manufacturing phases.

★ ★ ★

Mr. Cotsworth's activities, speeches and articles on the subject of stainless steel have earned for him an excellent reputation as an authority on heat and corrosion resisting iron base alloys.

Production Control-Organization and Functions

(*Continued from page* 1351)

Mechanical Products and, finally, Metals Planning including casting, scalping and rolling mills. To better visualize the need for three distinct sections, see Chart 2—showing metal flow.

★ ★ ★

As I mentioned earlier, the Newark plant produces a variety of products including Neoprene and Polyethylene weatherproof and service drop, battery and welding cable, RH-RW building wire, TW building wire, SEU, high voltage cable, ACSR, all aluminum, all aluminum alloy conductor, tie wire, rivet, welding wire, wire for further fabrication into nails, fencing and zippers. All sizes of screw machine stock, cold finished rod, rolled rod, forging stock, up to 21⅛″ diameter, and billets for extrusion from 3″ to 22″ round.

★ ★ ★

With the many products mentioned above, it becomes absolutely necessary to cast the many aluminum alloys to stock (we use approximately 35 alloys) depending on historical pattern and known business on the books. All the planning starts in our Remelt or Casting Department. Since we use the scheduled month order entry system, we must start casting by the 20th of the preceding month to allow for necessary consolidated casting and fabrication lead time.

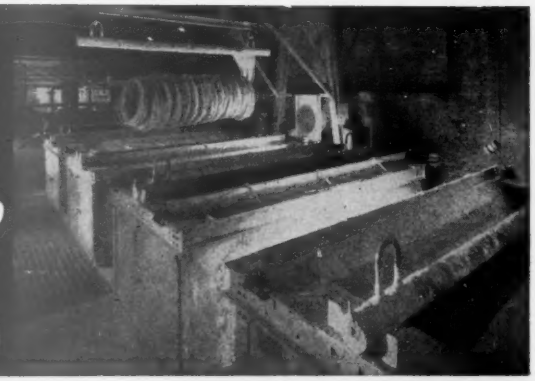
★ ★ ★

Our common language in planning and scheduling the casting and rolling mills is in terms of ingots and blooms.

★ ★ ★

Ninety-five percent of our alloy is produced in 12″ x 12″ ingots, weighing approximately 1,500 pounds. When this ingot is bloomed on the 38″ Mill, approximately five blooms 69″ x 6″ x 6″ are produced. Thus, we ignore weight as a scheduling term in Remelt and talk blooms, eliminating the need for crop allowance on the 38″ Mill and the approximate 15 per cent scalping loss. When an order is received, the weight is

carl mayer
HI-SPEED REGISTERED
ROD BAKERS



Faster baking, greater fuel economy, maximum production efficiency are just a few of the results of the exclusive heating arrangement of the Carl Mayer Hi-Speed Rod Baker. It also has a patented blow-off feature which removes moisture without damage to coils.

Here are just a few of our many satisfied customers:

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Atlas Steel Co.
Colorado Fuel & Iron Corp.
Crucible Steel Co. of America
Driver-Harris Co.
B. Greening Wire Co., Ltd.
Indiana Steel & Wire Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
Sheffield Steel Div., Armco Steel Corp.
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Patent Nos.
U. S. A. 2,296,361
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2,235,559
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converted to so many blooms for starting weight at the mills and then converted into ingots for casting requirements. All metal inventories are expressed in terms of blooms—the common denominator between casting and the fabricating departments.

★ ★ ★

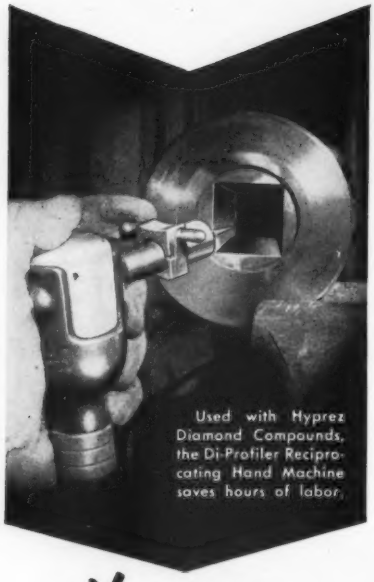
Our 22″ Mill (bar mill) produces straight length round, hexagonal, and square material from 1¼″ to 8″ rounds. Our method of planning this mill dictates the metal flow through the drawbenches, heat treat furnaces, straighteners, and saws. We use a Remington Rand "Sched-U-Graph" modified to meet our requirement. The 50-pocket board is calibrated into days and hours. We insert tabs showing the rolling size and colored cards to indicate the alloy to be rolled. The number of blooms divided by the rolling rate per hour dictates the lengths of the card which automatically machine-loads the mill. If additional business is received, we immediately know when the size will be rolled and then interpolate the shipping date. By using this board, we are always aware of the production task. In fact, we rarely close our schedules until the size is actually rolled. Basic in scheduling the 22″ Mill is the need for proper balance between our hexagonals and rounds since different straightening equipment is used, and balance between forging stock and screw machine stock to keep load level at the heat treat furnaces or other potential bottlenecks.

★ ★ ★

As material is rolled on the 22″ Mill, a numbered lot ticket (move ticket) is attached (showing starting weight and listing every operation). As each operation is completed, the operator writes date and shift completed. The lot numbers are used by Accounting to control work in process, by Production Control for scheduling, and by the Metallurgical Laboratory for release on properties and certifications.

★ ★ ★

Electrical Products—In conjunction with our Accounting Department, we have converted our com-



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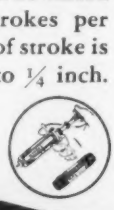

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plete planning and scheduling of the Insulation and Finishing Departments to IBM. As each item is received in the Sales Service Section, an IBM card is punched for each operation showing the shifts required and starting footage required. Each day, or as often as business dictates, a complete listing by operation by construction, in terms of shifts required, is given the Planning section. The Planner pulls the individual cards to be scheduled and returns them to our Tabulating Department which prints the schedule for each machine in each operation. Production against this schedule is reported back which in turn adjusts the open cards and prints a new listing for the planning departments. All cards are coded with the sales order numbers or stock numbers for identification both in Production Control and Accounting. The above system, although only briefly explained here, has many advantages. (1) A complete listing of all in-process material is readily available. (2) Human errors are minimized by the use of machines. (3) Actual business backlog expressed in terms of operation, shifts required and constructions are current to provide maximum service to customers.

Conclusions

We have attempted to show the importance of Production Control in today's economy. We have commented on those functions that are quite necessary but often overlooked. As we stated earlier, value from a well-organized Production Control Department can be gained only through the complete confidence of top management in the program and recognition of this department, as the Quarterback on a well-organized football team.

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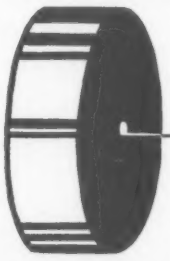

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The Coreless Coil—A New Wire Handling System

(*Continued from page* 1348)

8. **The** package should possess sales appeal. The uniform herringbone pattern in the rectangular package and the uniform rope effect on the circular package are pleasing to look at and give the customer assurance that he has a good product.

★ ★ ★

9. **It** should be possible to design the package for rotation or dead pay-off. Rotation of the rectangular pallet would be difficult to accomplish but the circular bundle may be designed with an inside diameter large enough to be put over an existing reel.

Advantages to the Wire Manufacturer

Too many times the wire manufacturer has been asked to sacrifice efficiency and raise his cost in order to meet a specification which will aid the wire user. In designing this package, I have tried to keep in mind at all times the maker of the wire as well as the user. As a result, in many operations, it appears that making this package will improve efficiency. For instance, there is no practical speed limitation. A great deal of work is being done to improve machinery laying down wire on the dead lay principle. It appears that, for producing large weights of wire, this will turn out to be the most practical method or design. It also eliminates the need for shutting down to remove coils, thereby making the machinery 100% continuous.

★ ★ ★

The Coreless Coiler will require less attention time and, especially when it is substituted for horizontal galvanizing, patenting and other similar blocks, it will be possible to speed up the operation and efficiency and scrap loss will not depend upon the skill of the operator. The reduced work load in tying, bundling and handling should improve tonnage per man hour.

★ ★ ★

Since the package is formed in the open and not in a container, a good view of the product can be had at all times. For this same reason, the reclamation of rejects is a fairly simple process. The controlled uniform layers of wire make the production of even weight coils no added chore. Likewise, the inventory of coils is made easy.

Summary

The Coreless Coiling Machine described here will, in general, produce either the rectangular or circular Coreless Coil on any metal or strand material that can be laid down by a dead block.

★ ★ ★

Everyone agrees that it would be nice to be able to package wire by one uniform method. Unfortunately, our industry is much too complex for this ideal situation. The great variety of uses of wire naturally poses many special packaging problems. The Coreless Coil seems to be the solution to many of those problems.

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Oxide Coatings on Aluminum Wire

(*Continued from page* 1343)

enamels normally used for insulation purposes, since it is relatively inelastic. The problem of low elasticity has been given considerable study because for electrical applications a suitable anodic film should have sufficient flexibility to allow bending or winding of the anodized wire without disrupting its continuity or affecting its dielectric strength. Research work to date has resulted in considerably improving the flexibility of the film, and round wire presently produced may be bent around a mandrel having a diameter three times that of the wire and still sustain a breakdown voltage in the neighbourhood of 150 volts. For higher breakdown voltages the bending diameter must, of course, be increased.

★ ★ ★

The optimum operating conditions for anodizing aluminum wire have not as yet been definitely established and research is still continuing in order to further improve the properties of the product. However, experience has indicated good results using an electrolyte consisting of a moderately concentrated sulphuric acid solution with small additions of chloride salts, an applied voltage of approximately 50 to 60 volts, 60 cycles, a current density in the range of 300 to 400 amperes per square foot and an operating temperature of from 10 to 20°C. The coating obtained under these conditions is amorphous alumina or aluminum oxide and is continuous and transparent with a porous structure.

★ ★ ★

The coating, because of its porous structure and adsorptive characteristics, can be coloured by the adsorption of dyes and by precipitation of pigments within the pores. From the standpoint of metal protection, however, it is more important that the pores can be closed or sealed by various procedures which increase the protective power of the coating. Thus, when it is desired to obtain the maximum corrosion resistance the coating is sealed subsequent to anodizing.

Uses for Anodized Wire

One of the main objects underlying the successful production of anodized aluminum wire was to provide at reasonable cost a material which could be used for electrical purposes and especially as windings in magnets, motors, reactors, transformers, etc. In order to be successful in this direction, the product should possess properties which would tend to offset the lower electrical conductivity of aluminum which, as is well known, is approximately 61% that of copper. In addition, the insulation afforded by the anodic film should be at least comparable with that of an enamel or cotton covering. As previously stated, the film will readily withstand a fairly high voltage without failure and in practice the potential difference between adjacent turns or layers in a coil rarely requires an insulation in excess of that pro-

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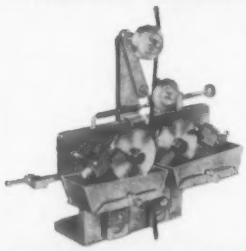
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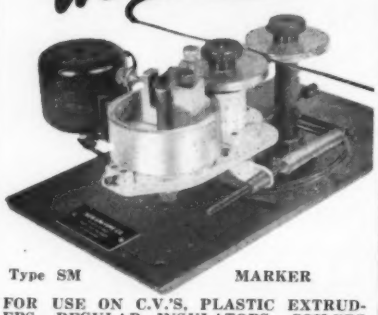

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vided by the anodic film. However, one of the main advantages of such a wire is its high heat resistance thereby allowing operating temperatures considerably above those possible with organic insulated wires. Also, of course, the oxide coating is very much thinner than the usual enamel or other coverings and this characteristic, along with the high heat resistance characteristic, should be taken into account when investigating the most economical coil designs when the space factor has to be considered. There are also instances where overall weight is of primary importance and in these cases aluminum anodized wire has an advantage. It should also be mentioned that aluminum anodized wire has excellent resistance to many of the common solvents which may attack certain organic insulations. While aluminum anodized wire has not been used commercially to any appreciable extent as yet, it is believed that such wire can and will be used with advantage for certain specific types of electrical equipment where its cost and unique characteristics will make it attractive to the electrical industry.

★ ★ ★

Owing to the extremely high electrical resistance of anodic coatings, they must be removed when it is desired to make low resistance contacts. This can be done by mechanical means, but there are acid and alkaline solutions which are effective in removing the oxide. After rinsing and drying the surface will again attain a thin natural film, but it can be removed easily by abrasion and if done through a suitable jointing compound the film will be prevented from re-forming.

★ ★ ★

In addition to electrical uses, anodized aluminum wire has found acceptance in the decorative and domestic fields and in particular for the production of wire screens. Its use for this purpose is not new but early attempts to anodize the woven material, and in particular to dye it, were not entirely successful. Now pre-anodized wire can be used, either plain or coloured, and a wire screen produced according to design.

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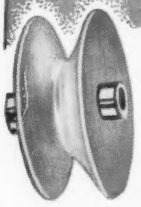

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Future Research

The work being done on anodized aluminum wire is not static and research is continuing on production problems such as electrolyte, applied voltage, current density etc. In addition, although extensive research has already been undertaken to elucidate the manner and rates of film growth, structure and various physico-chemical properties of oxide films on aluminum in general, research in this field is still in active progress and will no doubt continue for some time. In this connection, Aluminum Laboratories is presently working on the problem of natural film growth on commercial purity aluminum under relative humidities of from 52 to 100%. Although the study is not yet complete, available results indicate that after 100 days exposure the film thickness at 100% humidity is over four times that formed at 52% humidity. This is extremely interesting and infor-

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mative because it indicates that the natural films formed in highly humid atmospheres are considerably thicker than previously thought. The results of this and other research projects on anodizing problems will be appropriately published as they become available.

New All-Electric Spooler

The Robert J. Emory Co., 31 E. Runyon St., Newark 5, N. J., a leader in the field of high speed wire spooling for more than half-a-century, has announced that their new 1900 HVE spooler is now available.

★ ★ ★

The revolutionary feature is the replacement of the customary line shaft drive, with its sprockets, chains, brakes and clutches, with variable-speed A.C. motors, practically eliminating maintenance problems and lost production due to "down time."

★ ★ ★

Spindles are controlled independently through a push button station, allowing fast, smooth acceleration and rapid stopping of each individual spindle at any time. Pre-set speeds can be had by adjusting the power unit that supplies the bank of spindle motors and any spindle that is stopped will return to this pre-set speed when re-started.

★ ★ ★

This new arrangement assures increased production, complete flexibility of adjustment, uniform wire tension and extremely close winding. Each strand of wire lays parallel, eliminating overwinding or underwinding and tight or loose spaces.

★ ★ ★

Units can be built to wind wire from 0.003" to 0.080" and many flat sizes. The spool size and number of spindles can be made to meet most requirements of the spooling industry. Machines to spool heavier wire can be built to meet individual requirements.

★ ★ ★

The heart of the machine is the Emory traverse, which can be purchased separately. Full details will be sent upon request.

A.S.T.M. Publishes 1956 Proceedings

The 1956 edition of the A.S.T.M. Proceedings has recently been published. The 1,510-page volume records the accomplishments of the **American Society for Testing Materials** for the year 1956. It includes technical reports and papers with discussions.

★ ★ ★

Reports of 80 technical committees with appendices and 52 technical papers with discussions are included in the volume which contains a wealth of material for a variety of subjects.

★ ★ ★

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★ ★ ★

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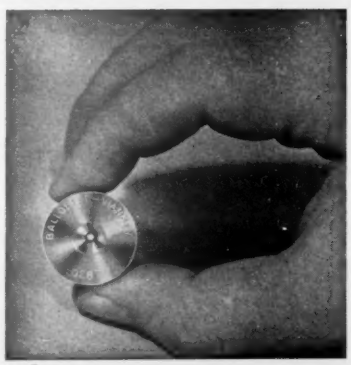

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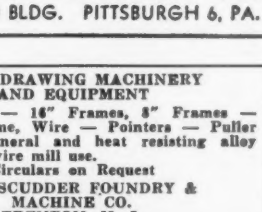
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(*Continued from page* 1367)

2% OOR, Specimen C is 7% OOR, and Specimen D is 7.5% OOR and fissured.

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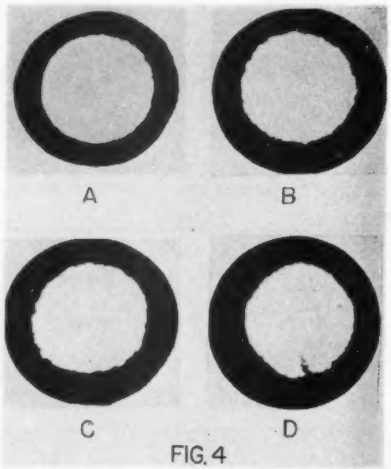

FIG. 4

Fig. 4—Transverse photomicrographs of 0.60-mg. (.0005") tungsten wire taken at 2500x for out-of-roundness measurements: (a) 0% OOR; (B) 2% OOR; (C) 7% OOR; and (D) 7.5% OOR and fissured.

Acknowledgment

The authors wish to thank **Mr. Roger R. Turk,** former Sylvania metallurgist, now with North American Aviation, Downey, California, for his assistance in developing this technique and for the preparation of the graph used in this article.

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For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Metallurgical Products Dept. of General Electric Co., Detroit
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Hoosier Wire Die., Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Electric, Adustable Speed
Allis, The Louis Co., Milwaukee, Wisc.

DRUMS—Wire Packaging
Continental Can Company, Van Wert, Ohio
Hubbard Spool Company, Garrett, Ind.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

ELECTRONIC PROCESS CONTROL DEVICES
Winstrom, Northampton, Mass.

ENGINEERS—Consulting
Bartell Machine-Tool Corporation, Rome, N. Y.
Wire Mill—Clarence S. Arms, Worcester, Mass.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FREQUENCY CHANGERS—
The Louis Allis Company, Milwaukee, Wisc.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Illinois

FURNACES—Galvanizing Equipment
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Illinois
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Illinois
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Illinois

FURNACES—Resisting Heating, Strand
Electric Furnace Company, Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Illinois

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio

FURNACES—Strand Annealing
Electric Furnace Company, Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Illinois

GAUGES—Electronic, for Springs
Winstrom, Northampton, Mass.

GAUGES—Wire Diameter, Continuous
Industrial Gauges Corporation, West Englewood, N. J.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GEARMOTORS—
The Louis Allis Company, Milwaukee, Wisc.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—For Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Aikali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS—
Bakelite Company Div. of Union Carbon & Carbide Corp., New York, N. Y.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
General Electric Company, Alkanex Wire Enamel Dept., Schenectady, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plymouth Cordage Company, Plymouth, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

INSULATING MATERIALS—Paper (For Electric Wire Cable)
Plymouth Cordage Company, Plymouth, Mass.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The, Philadelphia and Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Company, Harrison, N. J.
Rome Soap Mfg. Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen, Wurtt, Germany

MACHINERY—Bobbin Winders
Cedar West Tool Company, Inc., New York, N. Y.

MACHINERY—Braiding
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York, N. Y.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., Shelton, Conn.
Wafios Maschinenfabrik, Reutlingen, Wurtt, Germany

MACHINERY—Closing Rope
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling & Rewinding Strip
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Herborn, Maschinenfabrik, Herborn, Germany
Morgardshammer Mek Verstads A. B., Morgardshammer, Sweden.
National Mach'y Exch (Used), New York
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Patterson Machine, Geo. C., Co., Cleveland, Ohio

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Maschinenfabrik, Herborn, Germany

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Detroit
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven, Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Nilson, A. H. Machine Co., Shelton, Conn.
Wafios Maschinenfabrik, Reutlingen, Wurtt, Germany

MACHINERY—Galvanizing Wire
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Slitting
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Mfg. Co., Wallingford, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Hydraulic
Manco Mfg. Co., Bradley, Illinois

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Beard Machine Co., York, Pa.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Labeling Electric Wire
Dewyer, Inc., Libertyville, Ill.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia
Cook Mfg. Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, O.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Cedar West Tool Company, Inc., New York, N. Y.
E. V. G., Richard Kleinhans, New York, N. Y.
Maschinen & Stahl A. G., c/o Richard Kleinhans, Zurich, Switzerland
Wafios Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Durant Mfg Co., Milwaukee, Wis.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Godderidge Ste., Houilles (Seine-et-Oise), France

MACHINERY—Plating
Hodge Bros. Machine Shop, Ossining, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York,
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Polishing Asbestos Wire
Beard Machine Co., York, Pa.

MACHINERY—Printing on Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M. Co., Inc., Boylston, Mass.

MACHINERY—Re-Spooling
Bartell Machine-Tool Corporation, Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Industrial Winding Machinery Co., New York, N. Y.
National Mach'y Exch. (Used), New York N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Company, Cleveland, Ohio
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Scrubbing, Steel Strip
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Metal
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Spark Testing
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Peschel Electronics, Inc., New Rochelle, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Splicing (Strip)
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Staple
Nilson, A. H. Machine Co., Shelton, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Straightening & Cutting
Breitenbach, Wilhelm, Unna, Germany
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Patterson Machine, Geo. C., Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening (Strip Leveling)
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Stranding
Bartell Machine-Tool Corporation, Rome, N. Y.
Godderidge Ste., Houilles, (Seine-et-Oise), France
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Breitenbach, Wilhelm, Unna, Germany
Colbourne Machine Company, Winsted, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Federal Mfg. Co., Wallingford, Conn.
Peschel Electronics, Inc., New Rochelle, N. Y.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine-Tool Corporation, Rome, N. Y.
Cook Manufacturing Co., The, Paterson, N. J.
Godderidge Ste., Houilles (Seine-et-Oise), France
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—Welded Wire Mesh
E. V. G., Richard Kleinhans, New York, N. Y.
Maschinen & Stahl A. G., c/o Richard Kleinhans, Zurich, Switzerland
Manco Mfg. Co., Bradley, Illinois
National Electric Welding Machines Co., Bay City, Michigan

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery —Welding Wire Fabrics)

MACHINERY—Winding Wire
Emory Company, Robert J., Newark, N. J.
Federal Manufacturing Company, Wallingford, Conn.
Industrial Winding Machinery Co., New York, N. Y.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
Breitenbach, Wilhelm, Unna, Germany
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Federal Mfg. Co., Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Morgan Construction Co., Worcester, Mass.
Morgardshammer Mek Verstads AB, Morgardshammer, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Wire Forming
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Shelton, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Co., Boston, Mass.

MANDRELS—Extrusion
Bartell Machine-Tool Corporation, Rome, N. Y.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS—Electric, A.C. & D.C.
The Louis Allis Company, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Company, Winsted, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging (See Drums—Wire Packaging)

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAPER—Creped Wrapping
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Rinkle, Krinkle Paper Co., Inc., Boston, Mass.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Rinkle, Krinkle Paper Co., Inc., Boston, Mass.
Terkelsen Machine Co., Boston, Mass.

PAPER—Insulating
Plymouth Cordage Company, Plymouth, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PATENT—ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Monsanto Chemical Company, Plastics Division, St. Louis, Mo.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.

PLASTICS COMPOUNDING—Custom
Plandex Corporation, Downingtown, Pa.

PLASTICS—for Wire Insulation
Bakelite Company Div. of Union Carbon & Carbide Corporation, New York, N. Y.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plandex Corporation, Downingtown, Pa.
Shawinigan Resins Corporation, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PRINTING WHEELS—for Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gillies, Duncan M. Co., Inc. Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

PUMPS—Molten Metal
Fisher Associates, New York, N. Y.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Industrial Ovens, Inc., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Garrett, Ind.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Nelson Company, The, Baltimore, Md.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Strip Steel
Steel Equipment Company, Cleveland, Ohio

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Nilson, A. H. Machine Co., Shelton, Conn.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Nelson Company, The, Baltimore, Md.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Aluminum
Aluminum Company of America, Pittsburgh, Pa.

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Aluminum Company of America, Pittsburgh, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Phosphor Bronze Div., Seymour, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SHEARS—Wire, Rod, Billet
Manco Mfg. Co., Bradley, Illinois

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Plastic
Hubbard Spool Company, Garrett, Indiana
Standard Mill Supply, Co., Pawtucket, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois

STRAIGHTENERS—Portable Rod
Manco Mfg. Co., Bradley, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWITCHES—Electronic Sensing
Winstrom, Northampton, Mass.

TABLES—Press Feeding
Jarke Manufacturing Co., Chicago, Illinois

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TOOLS—Wire Cutting
Porter, H. K., Inc., Somerville, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Bartell Machine-Tool Corporation, Rome, N. Y.
Emory Company, Robert J., Newark, N. J.
Hodge Bros. Machine Shop, Ossining, N. Y.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Alkanex Wire Enamel Dept., Schenectady, N. Y.
Shawinigan Resins Corporation, Springfield, Mass.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila, Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
Micro Products Co., Chicago, Ill.
Strecker, August, K.G., Limburg/Lahn, W. Germany

WHEELS—for Printing on Electric Wire
Gem Gravure Company, West Hanover, Mass.

WIRE—Aluminum
Aluminum Company of America, Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Chase Brass & Copper Co., Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Company, Phosphor Bronze Div., Seymour, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Chase Brass & Copper Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat, Fine
Montgomery Co., The, Windsor Locks, Conn.
National Standard Company, Niles, Mich.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
Aluminum Company of America, Pittsburgh, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside Alloy Metal Division, Prospect Park, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Company, Phosphor Bronze Div., Seymour, Conn.
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Metalizing
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Worcester Wire Works Div., National-Standard Company, Worcester, Mass.

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Chase Brass & Copper Co., Waterbury, Conn.
Malin & Co., The, Cleveland, Ohio
Porter Company, Inc., H. K., Riverside Alloy Metal Division, Prospect Park, Pa.
Seymour Mfg. Co., Phosphor Bronze Div., Seymour, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Porter Company, Inc., H. K., Riverside Alloy Metal Division, Prospect Park, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside Alloy Metal Division, Prospect Park, Pa.
Roebling's John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Crucible Steel Co. of America, Pittsburgh, Pa.
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Crucible Steel Co. of America, Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside Alloy Metal Division, Prospect Park, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

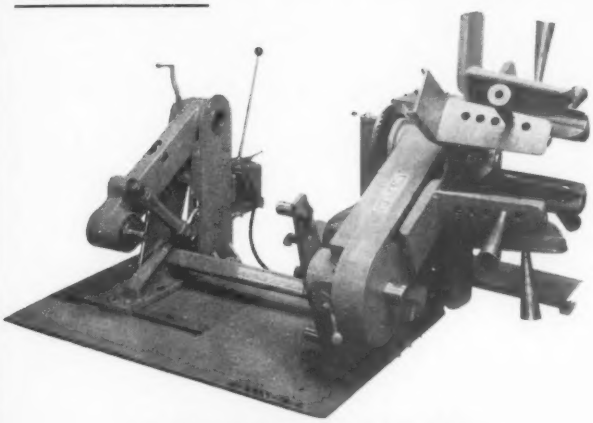
PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

WATSON

REWINDERS AND COILERS

THESE UNITS, DESIGNED FOR HEAVIEST DUTIES, ARE THE PREFERRED STANDARD IN CORDAGE, CABLE AND WIRE ROPE SHIPPING ROOMS AND WAREHOUSES. THEY ARE SELF-POWERED AND EQUIPPED WITH MULTI-SPEED SLIDE GEAR TRANSMISSIONS. FOOT TREADLE CONTROLS SMOOTH ACCELERATION AND ADJUSTABLE AUTOMATIC BRAKE CONTROLS COASTING. COILING HEADS ARE OPTIONAL AND REMOVABLE. ILLUSTRATIONS SHOW MOST POPULAR MODELS, BUT OTHERS RANGING FROM 16" TO 120" SIZES ARE ALSO AVAILABLE.



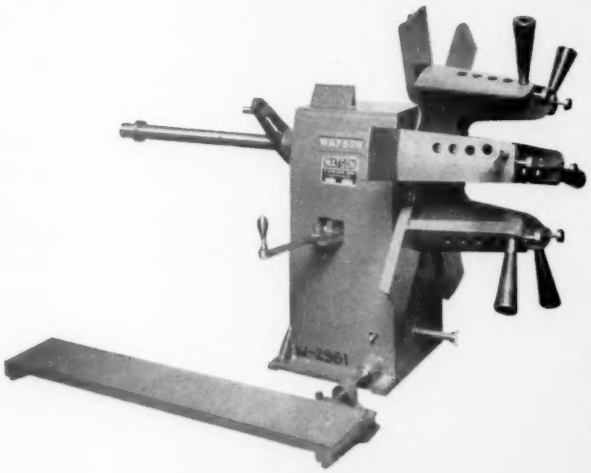
"SHAFTLESS" TYPE "H"

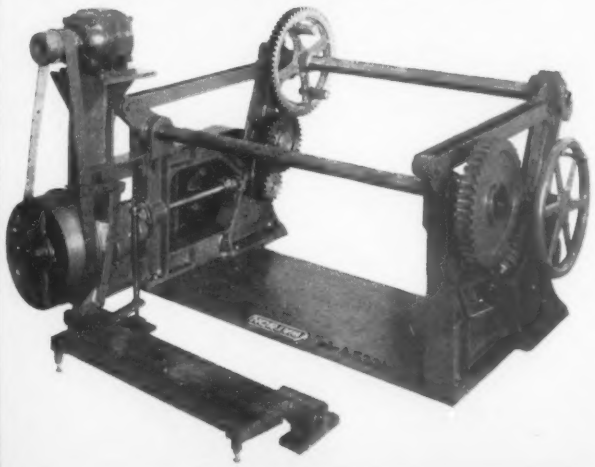
U. S. Patent No. 2,624,522

BUILT IN 50"-3 TON AND 72"-6 TON SIZES. SIX SPEED DRIVE. REEL DRIVE ALWAYS IN MESH REGARDLESS OF POSITION AND REQUIRES MERELY FLOOR CLEARANCE FOR REEL ROTATION. OUTSTANDING FEATURES ARE *SAFETY* DUE TO REEL SHAFT ABSENCE, WITH *RAPIDITY* AND *EASE* OF REEL MANIPULATION. 50" SIZE UNIT SHOWN WITH A 24" ADJUSTABLE WIDTH, HEAVY DUTY COILING HEAD IN POSITION.

"FIXED SHAFT" TYPE "RC-54"

THIS LOW COST BALL-BEARING MODEL REQUIRES A HOIST FOR REEL LOADING. IT HAS THREE SPEEDS AND BUILT-IN MOTOR. RECEIVES REELS TO 54" FLANGE DIA.. LOAD LIMIT IS REACHED WITH STD. 2-5/16" DIA. SHAFT WHEN REEL WEIGHT IN POUNDS MULTIPLIED BY REEL WIDTH IN INCHES DOES NOT EXCEED 75,000 IN.-LBS. OPTIONAL COILING HEAD SHOWN IN POSITION. REEL SHAFT MAY EXTEND ON BOTH SIDES.





"MECHANICAL LIFT" TYPE "W"

U. S. Patent No. 1,867,688

AVAILABLE IN ALL SIZES TO 84"-6 TON MAXIMUM. THE UNIT SHOWN IS A 60"-4 TON UNIT, WITH GUARD REMOVED TO SHOW INPUT DRIVE. FREELY ACTING BALL-BEARING WORM-WHEEL LIFT. FLOOR CLEARANCE ONLY IS REQUIRED FOR REEL ROTATION. FIVE SPEEDS. REEL SHAFT MAY BE EXTENDED TO MOUNT COILING HEAD.

11-57

AGING

ALUMINIZING

ANNEALING

BILLET HEATING

BRAZING

BRIGHT ANNEALING

CARBON RESTORATION

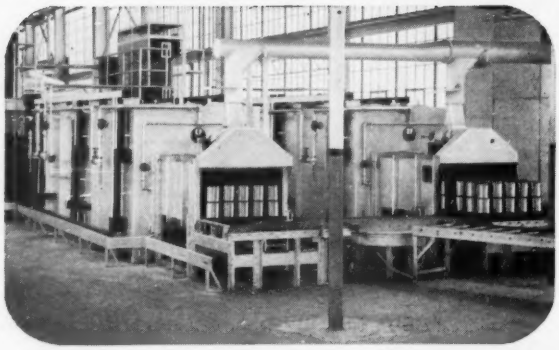
CARBURIZING

CERAMIC DECORATING

DRAWING

ENAMELING

EF gas-fired and electric furnaces are built in many sizes and types for bright annealing wire on spools or reels, in coils or strands—ferrous and non-ferrous, including stainless.



Clean annealing nickel-silver and other alloy wire in an EF gas fired radiant tube continous roller hearth furnace. Handles coils up to 30" in diameter.

EF PRODUCTION FURNACES

for these and other processes

GALVANIZING

HARDENING

HOMOGENIZING

MALLEABLIZING

NORMALIZING

NITRIDING

SINTERING

SOLUTION TREATING

STRESS RELIEVING

STRIP—ANY PROCESS

SPECIAL ATMOSPHERE TREATMENTS AND OTHER PROCESSING

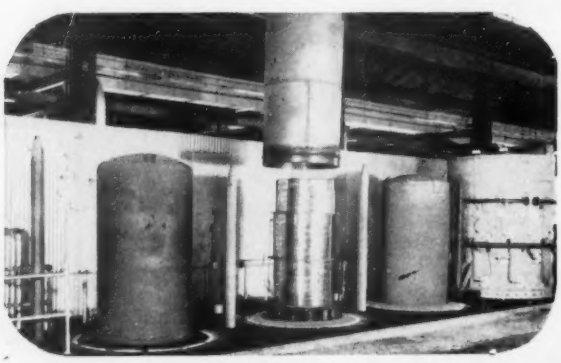
• Reflecting more than 40 years of continuous research, experience and outstanding engineering accomplishments, EF production furnaces combine high heating efficiency — accurate, automatically controlled cycles — high fuel economy—and produce products with uniform physicals and surface finish year after year.

For advanced engineering designs that minimize maintenance and produce high hourly outputs, turn your production furnace problems over to experienced EF furnace engineers — IT PAYS.

THE ELECTRIC FURNACE CO.

GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio

Canadian Associates • CANEFCO LIMITED • Toronto 1, Canada

EF gas fired and electric bell, pit and other batch and continuous type furnaces are available for normalizing rod, annealing wire, strip and other processes.